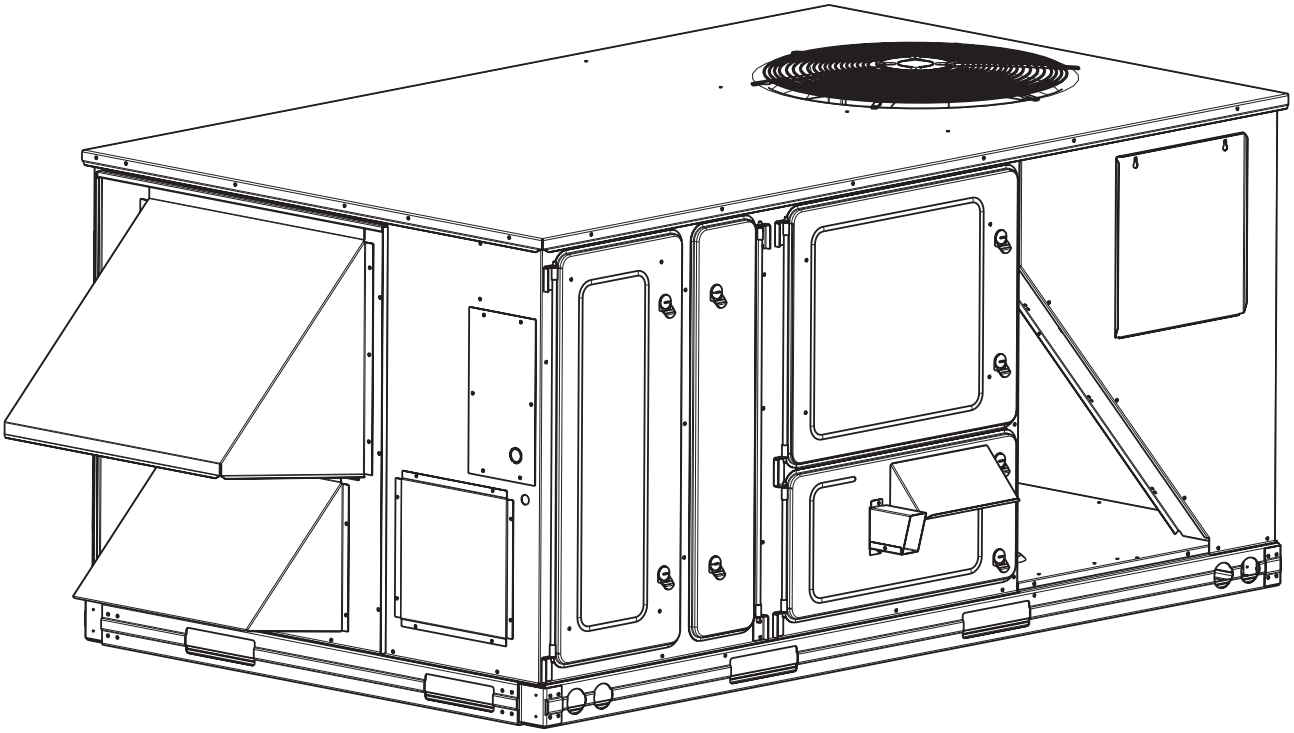
48PD05–06
Displacement Ventilation or Single Zone Variable Airflow Rooftop Units Single Package, Electric Cool, Gas Heating with PURON® (R–410A) Refrigerant and *COMFORT*Link™ Controls

Carrier
turn to the experts

Product Data

CENTURION



Puron
the environmentally sound refrigerant

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Printed in U.S.A. Edition Date: 06/10

Catalog No:48PD–01PD

Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.

Replaces: NEW

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FEATURES AND BENEFITS

The Centurion 48PD rooftop units use Puron® (R-410A) refrigerant and *Comfort*Link™ DDC controls. These units are intended to be used in a either a displacement ventilation or a single-zone variable air volume application. In addition, the standard features and benefits of a Centurion rooftop unit, the PD units include a factory installed variable capacity compressor and variable frequency drive indoor fan motor.

Performance Features Include:

- Puron (R-410A) HFC refrigerant
- SEER up to 15.2, EER up to 12.8
- AHRI certified outdoor sound levels as low as 72 db
- Fully hermetic, digital scroll compressors with capacity modulation provide any capacity between 15 and 100%.
- *Comfort*Link Direct Digital Controls (DDC)
- Phase loss and compressor reverse rotation protection
- TXV refrigerant metering system on each circuit
- High Pressure, Low Pressure/Loss of charge, and Freeze protection.
- Solid core liquid line filter drier on each circuit.
- Ambient cooling operation from 0°F up to 125°F
- Foil faced insulation throughout entire unit
- Pre-painted exterior panels and primer-coated interior panels tested to 500 hours ASTM B117 (scribed specimen)salt spray protection
- Rust-proof, internally sloped condensate pan conforms to ASHRAE 62 standards
- Evaporator fan motor system with high performance belt drives and variable speed motors from 20% to 100%
- Internally protected, shaft down totally enclosed condenser motors
- 2 inch filter standard, field convertible to 4 inch capability
- 24 volt control system with resettable circuit breakers
- Induced draft combustion (gas units)
- Redundant gas valves with up to two stages of heating
- ENERGY STAR qualified

Maintenance Features Include:

- Single slab, single pass evaporator and condenser coils with dual side access panels
- Hinged access doors with, quick turn latches and door retainers
- Slide out indoor fan assembly for added service convenience
- Dedicated, fully insulated compressor compartment
- Rust-proof, slide out evaporator condensate pan
- Permanently lubricated evaporator, condenser and inducer motors

Installation Features Include:

- Thru the bottom and side weather tight electrical access plate
- Thru the bottom and side gas connection capabilities
- Single point electrical and gas connections
- Return and supply duct fits between 24” on center joist
- Field convertible from vertical to horizontal airflow
- Single piece outdoor air hoods
- Full perimeter base rail with built-in rigging adapters and fork truck slots

Factory Installed Options Include:

- Supply and/or return air smoke detectors
- Powered or non-powered 115 volt convenience outlet
- Non-fused disconnect switch or circuit breaker
- Dry bulb or enthalpy economizer with/without return air CO_2 sensor
- Two-position motorized outdoor damper
- Barometric relief damper
- Power Exhaust
- Condenser coil guard
- Copper/Copper coils
- Pre-coated condenser coil
- E-coated coils
- Fan status and filter status switches
- High static indoor fan and drive systems
- Stainless steel gas heat exchanger (gas units)
- Low NOx models that meet California Air Quality Management requirements (gas units)

UNIT SUMMARY

There are two key elements that separate a Centurion PD unit from other Centurion units; the use of a variable speed fan and a modulating compressor. The modulating compressor allows the fan speed to slow down without the refrigerant coil freezing during low load, and also allows for variable supply air temperatures. In general, a space temperature input is used to control the airflow and a supply air temperature input is used to control the compressor load. All other components of this machine are similar to concepts used on other Carrier package units. An economizer is used to take advantage of any free cooling opportunities in addition to providing the required outside air. Additionally, all units will come standard with factory installed *Comfort*Link™ controls which makes demand controlled ventilation easy to install and implement. If this unit is to be integrated with an open protocol type building automaton system a translator card or LEI card can be installed and the unit can be viewed on an up front system. If humidity is a concern, a humidistat can be installed in the zone, and the indoor fan will slow down to ensure proper moisture removal from the supply air.

Although this unit was designed for the requirements of a displacement ventilation system, it can also be used in a single-zone variable air volume application. However, the use of a supply air pressure input to control the Centurion PD unit is not supported nor recommended; the unit is not designed to provide a constant supply air pressure.

Centurion PD units are ideal on buildings that are looking for either maintenance friendly units or trying to achieve LEED certification. The units have a high SEER value, but more importantly, the modulating compressor and fan system allow a significant reduction in overall energy consumption beyond what is quantified by the SEER value. This can contribute significantly to the LEED intent of achieving overall lower building energy consumption. Initial studies have shown that a Centurion PD unit can use up to 35% fewer kilowatts than a typical constant volume unit over the cooling season.

DISPLACEMENT VENTILATION SUMMARY

Displacement Ventilation (DV) systems are very closely related to the design of underfloor air systems. Although the air delivery method is slightly different, the design philosophy is the same. Displacement ventilation discharges air horizontally near the floor at very low velocities and near laminar flow conditions. The goal is to use only the buoyancy effects to create air motion within the space and maintain the stratification layer above the controlled zone that is not mixed. The air is introduced at the floor level at approximately 65°F and the air moves upward through the space taking both heat and any contaminants that might be in the air up out of the occupied space to the ceiling. Unlike displacement ventilation a mixing ventilation system requires more cooling capacity since air must be cooled significantly before it is introduced into the classroom or office. Displacement ventilation does not require the same cooling capacity; it uses warmer air delivered at 63° to 68° to achieve that same space set point.

The DV system use is a feasible alternative to the current practice of mixing air distribution systems. It is energy efficient, quiet and distributes air more efficiently than other ventilation systems. It improves the indoor air quality (IAQ) by providing supply air directly to building occupants and saves energy by conditioning only the lower occupied portion of a space. Displacement Ventilation is a means of providing cool supply air directly to the occupants in a room such as a classroom or auditorium. In the case of a school classroom, cooling is localized where the occupants are located. The air is heated or cooled so that it enters the room at ~65°F, considerably warmer than with a conventional air conditioning system.

The fresh air, supplied near the floor at a very low velocity, falls towards the floor due to gravity and spreads across the room until it comes in contact with heat sources, such as people and computers. As this cool air picks up heat from the school's occupants and equipment it slowly rises. This creates a vertical airflow pattern near each occupant: often called a thermal plume. Contaminants such as germs are caught in the thermal plume and removed from each occupant toward the ceiling, where they exit the classroom or auditorium.

Displacement Ventilation applications are desirable due to the potential for energy savings that result from only having to size unit capacities for approximately 1/3 the zone volume used for conventional constant volume packaged rooftop unit applications. In practices, displacement ventilation applications have recorded 30-35% less kilo-watt/hr usage when compared to a similarly efficient constant volume unit. See the California Energy Commission Displacement Ventilation Design Guide for further details on displacement ventilation.

Refer to Carrier Application Data for the 45XC (Catalog No. 04-51450001-01) for the design of Underfloor Air Distribution Systems for additional details on Displacement Ventilation Application and Design.

SINGLE-ZONE VAV SUMMARY

A Single-Zone Variable Air Volume (VAV) concept utilizes a variable capacity compressor system and a variable speed fan system to modulate the cooling, dehumidification and airflow as required meeting the space needs. Unlike traditional VAV applications, there are no mixing boxes or bypass ducts because the application is a single zone. The space temperature can be set and maintained very accurately using a space temperature sensor (not a thermostat). Space humidity control is a built in feature with the addition of a humidistat. Supply air temperatures and airflows will vary based on the demand from the space.

Design parameters of the system should be based around the maximum cooling and heating design parameters, just like on a constant volume system. The unit will modulate the cooling, dehumidification and airflow to meet not only the design cooling demand, but the part-load cooling and dehumidification demand as well. Good applications for Single-Zone VAV include any situation where a constant volume unit would be used, but one or more of the following criteria are desired:

More consistent space conditioning

With the combination of the modulating compressor and variable speed indoor fan, the unit will be able to maintain a much more consistent space temperature and/or humidity level than a traditional CV unit which must cycle the compressor on/off.

Significant energy savings

With the combination of the modulating compressor and variable speed indoor fan, the unit will use less power over the cooling season. Job site application measurement data indicates that the PD units can use up to 40% less kW/h than the same size & efficiency constant volume unit.

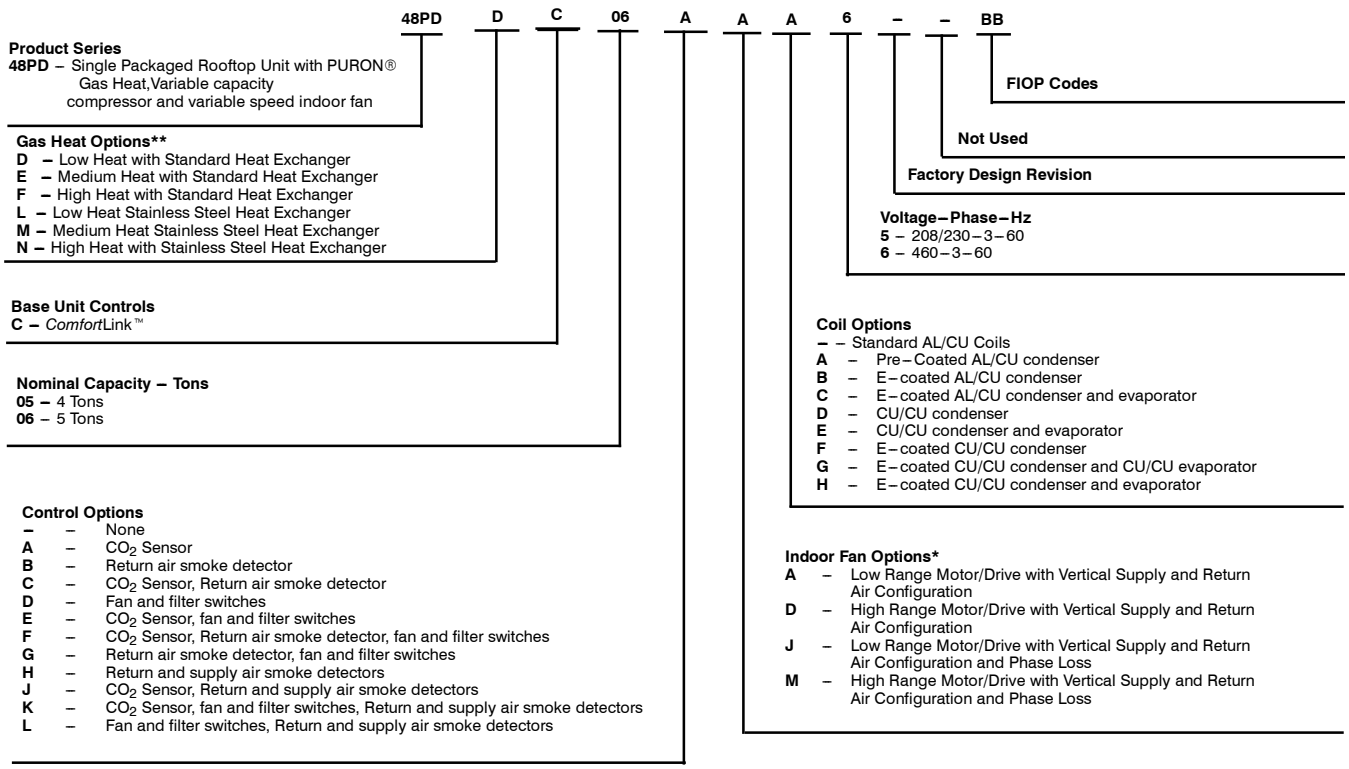
Reduced indoor fan noise

With the variable speed indoor fan, indoor airflow noise & fan start-up noise will be significantly reduced.

Increased ventilation air

With the combination of the modulating compressor and variable speed indoor fan, the unit can achieve higher volumes of outside air and still achieve typical supply air conditions.

MODEL NUMBER NOMENCLATURE


48PD D C 06 A A A 6 – – BB
Product Series
48PD – Single Packaged Rooftop Unit with PURON® Gas Heat,Variable capacity compressor and variable speed indoor fan
Gas Heat Options**
D – Low Heat with Standard Heat Exchanger
E – Medium Heat with Standard Heat Exchanger
F – High Heat with Standard Heat Exchanger
L – Low Heat Stainless Steel Heat Exchanger
M – Medium Heat Stainless Steel Heat Exchanger
N – High Heat with Stainless Steel Heat Exchanger
Base Unit Controls
C – ComfortLink™
Nominal Capacity – Tons
05 – 4 Tons
06 – 5 Tons
Control Options
– – None
A – CO2 Sensor
B – Return air smoke detector
C – CO2 Sensor, Return air smoke detector
D – Fan and filter switches
E – CO2 Sensor, fan and filter switches
F – CO2 Sensor, Return air smoke detector, fan and filter switches
G – Return air smoke detector, fan and filter switches
H – Return and supply air smoke detectors
J – CO2 Sensor, Return and supply air smoke detectors
K – CO2 Sensor, fan and filter switches, Return and supply air smoke detectors
L – Fan and filter switches, Return and supply air smoke detectors
Indoor Fan Options*
A – Low Range Motor/Drive with Vertical Supply and Return Air Configuration
D – High Range Motor/Drive with Vertical Supply and Return Air Configuration
J – Low Range Motor/Drive with Vertical Supply and Return Air Configuration and Phase Loss
M – High Range Motor/Drive with Vertical Supply and Return Air Configuration and Phase Loss
Coil Options
– – Standard AL/CU Coils
A – Pre–Coated AL/CU condenser
B – E–coated AL/CU condenser
C – E–coated AL/CU condenser and evaporator
D – CU/CU condenser
E – CU/CU condenser and evaporator
F – E–coated CU/CU condenser
G – E–coated CU/CU condenser and CU/CU evaporator
H – E–coated CU/CU condenser and evaporator
Voltage–Phase–Hz
5 – 208/230–3–60
6 – 460–3–60
Factory Design Revision
Not Used
FIOP Codes

* Units are field convertible to horizontal supply and/or return air configuration. Horizontal conversion may require different accessory devices.

** Gas heat options L, M, and N are compliant with the California Low NOx requirements.

Quality Assurance
Certified to ISO 9001:2000

DEALER DESIGN AWARDS
theNEWS | GOLD

BUILDINGS magazine
Editors' Choice
TOP 100 PRODUCTS
2005

ENERGY STAR

This product has been designed and manufactured to meet Energy Star® criteria for energy efficiency. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow all manufacturer's refrigerant charging and air flow instructions. **Failure to confirm proper charge and air flow may reduce energy efficiency and shorten equipment life.**

ASHRAE 90.1 COMPLIANT

Well exceeds ASHRAE 90.1 and Energy Star Standards

AHRI CAPACITY RATINGS

UNIT 48PD	NOMINAL CAPACITY (Tons)*	COOLING CAPACITY (MBtuh)	SEER	EER	RATED CFM	SOUND RATING (dB)
05	4	47,500	15.2	12.55	1,600	72
06	5	58,500	14.65	12.25	1,750	78

* Nominal cooling tons shown is the maximum design capacity value.

LEGEND

AHRI – Air Conditioning, Heating and Refrigeration Institute Test Standard

dB – Decibel

EER – Energy Efficiency Ratio

SEER – Seasonal Energy Efficiency Ratio

NOTES:

1. Tested in accordance with AHRI Standards 210/240.
2. Ratings are net values, reflecting the effects of circulating fan heat.
3. Ratings are based on:

Cooling Standard: 80 F db, 67 F wb indoor entering–air temperature and 95 F db air entering outdoor unit.

4. All 48PD units are in compliance with ENERGY STAR® and ASHRAE 90.1 2004 Energy Standard for minimum SEER and EER requirements.
5. Units are rated in accordance with AHRI sound standards 270 or 370.

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program For verification of certification for individual products, go to www.ahridirectory.org.

Outdoor Sound Power (Total Unit)

UNIT 48PD	AHRI RATING (dB)	A–WEIGHTED (dB)	OCTAVE BAND LEVELS dB							
			63	125	250	500	1000	2000	4000	8000
05	72	82.6	80.1	81.1	78.8	77.2	77.4	76.4	72.4	70
06	78	83.8	82.4	83.4	81.6	79.1	78.8	76.9	72.9	70.2

LEGEND

AHRI – Air Conditioning, Heating and Refrigeration Institute Test Standard

dB – Decibel

NOTE:

–Indoor sound power is available via Carrier's Electronic Catalog Program for specific operating parameters.

–Because Centurion PD units utilize a variable speed indoor fan system, the resulting indoor sound values are 6–8 dB below a similar unit with constant volume airflow.

GAS HEATING CAPACITIES AND EFFICIENCIES

Vertical and Horizontal Supply Units with Natural Gas (Three Phase)

48PD		HEATING INPUT Stage 2 (Btuh)	HEATING INPUT Stage 1 (Btuh)	OUTPUT CAPACITY Stage 2 (Btuh)	TEMPERATURE RISE Min – Max (F)	MINIMUM HEATING CFM**	THERMAL EFFICIENCY (%)
Standard	Stainless Steel						
—	L05*	51,000	35,700	41,300	25 – 70	500	81.0
D05	—	56,000	39,200	45,400	25 – 70	600	
E05	M05	75,000	52,500	60,800	20 – 60	940	
F05	N05*	113,000	79,100	91,500	30 – 75	1,130	
D06	L06*	75,000	52,500	60,800	20 – 60	940	81.0
E06	M06*	113,000	79,100	91,500	30 – 75	1,130	
F06	N06*	151,000	105,700	122,300	45 – 75	1,510	

Vertical and Horizontal Supply Units With Propane Gas (Three Phase)

48PD		HEATING INPUT Stage 2 (Btuh)	HEATING INPUT Stage 1 (Btuh)	OUTPUT CAPACITY Stage 2 (Btuh)	TEMPERATURE RISE Min – Max (F)	MINIMUM HEATING CFM**	THERMAL EFFICIENCY (%)
Standard	Stainless Steel**						
D05	L05	55,000	38,500	44,600	25 – 70	600	81.0
E05	M05	74,000	51,800	60,000	20 – 60	940	
F05	N05	111,000	77,700	90,000	30 – 75	1,130	
D06	L06	74,000	51,800	60,000	20 – 60	940	81.0
E06	M06	111,000	77,700	90,000	30 – 75	1,130	
F06	N06	148,000	103,600	120,000	45 – 75	1,510	

NG Altitude Compensation* — 48PD

ELEVATION (ft)	NATURAL GAS ORIFICE SIZE†	LP ORIFICE SIZE†
0 – 1,999	45	52
2,000	47	52
3,000	47	53
4,000	47	53
5,000	48	53
6,000	48	53
7,000	48	53
8,000	49	54
9,000	49	54
10,000	50	54
11,000	51	54
12,000	51	55
13,000	52	55
14,000	52	56

Orifice Quantity — 48PD

UNIT	05	06
Low Heat (D/L)	3	4
Medium Heat (E/M)	4	6
High Heat (F/N)	6	8

* As the height above sea level increases, there is less oxygen per cubic foot of air. Therefore, heat input rate should be reduced at higher altitudes. Includes a 4% input reduction per each 1000 ft.

** Gas heat options L, M and N are compliant with the California Low NOx requirements

† Orifices available through your local Carrier dealer.

PHYSICAL DATA

BASE UNIT 48PD	05	06
NOMINAL CAPACITY (Tons)	4	5
OPERATING WEIGHT (lb)*		
Base Unit	901	921
Economizer		
Vertical	40	40
Horizontal	50	50
Roof Curb		
14-in.	122	122
24-in.	184	184
REFRIGERANT SYSTEM		
Refrigerant	Puron® (R−410A) Refrigerant	
Metering Device	Balanced−Port TXV with Bypass	
# Circuits/ # Compressors	1/1	1/1
Charge (lb)	14.5	16.0
High Pressure Switch Cutout (psig)	660 ± 10	660 ± 10
High Pressure Switch Auto Reset (psig)	505 ± 20	505 ± 20
COMPRESSOR	Copeland Digital Scroll	
Oil Type	Copeland 3MA	
Oil (oz)	42	42
CONDENSER COIL	Round Tube Plate Fin	
Circuit	Outer/Inner	Outer/Inner
Rows...Fins/in.	2…17	2…17
Face Area (sq ft)	12.6	12.6
CONDENSER FAN	Propeller	
Quantity…Diameter (in.)	1…24	1…24
Nominal Cfm (Total, all fans)	3500	3500
Motor Nominal Hp/Watts	0.125/227	0.25/351
Nominal Rpm	825	1100
EVAPORATOR COIL	Round Tube Plate Fin	
Standard Coil Tube/Fins	Cu/Al	Cu/Al
Rows…Fins/in.	2…15	3…15
Face Area (sq ft)	9.3	9.3
Condensate drain conn size (in.)	3/4 NPT	3/4 NPT
EVAPORATOR FAN (See motor and drive tables)		
Fan Quantity/Type	1/Belt	1/Belt
Belt Size (in.)	12 x 9	12 x 9
Blower Pulley Type	Fixed	Fixed
Fan Type	Centrifugal	Centrifugal
Fan Bearing Type	Ball−Concentric Lock	Ball−Concentric Lock
Maximum Fan RPM	2000	2000
Blower Shaft Diameter (in.)	0.75	0.75
Motor Max HP	2.4	2.4
Motor Frame Size	56Hz	56Hz
FILTERS		
Unit Filter Type	Fiberglass fill, non−pleated	Fiberglass fill, non−pleated
Unit Filter Qty/Size (in.)	4/16 x 20 x 2	4/16 x 20 x 2
Economizer OA Inlet Screen Qty/Size (in.)	1/25.8 x 16.4	1/25.8 x 16.4

* Aluminum evaporator coil/aluminum condenser coil with low heat

BASE UNIT 48PD	05	06
GAS HEAT SECTION		
# of Gas Valves	1	1
Gas Supply Line Pressure Range (in.wg)	5.0–13.0	5.0–13.0
Gas Supply Line Pressure Range (PSIG)	0.180–0.469	0.180–0.469
Manifold Pressure (in.wg)		195
Natural Gas Vertical/Horizontal	3.50/3.50	3.50/3.50
Liquid Propane Vertical/Horizontal	3.50/3.50	3.50/3.50
Thermostat Heat Anticipator Setting (amps)	NA†	NA†
Field Gas Connection Size (in.)	1/2	1/2
Natural Gas		
Low Heat		
# of burners (total)	3	4
Rollout switch opens/closes (deg F)	195/115	195/115
Temperature Rise Min – Max (deg F)	25 – 70	25 – 60
Burner Orifice Diameter (in./drill size)**	0.0820/45	0.0820/45
Medium Heat		
# of burners (total)	4	6
Rollout switch opens/closes (deg F)	195/115	225/175
Temperature Rise Min – Max (deg F)	25 – 60	30 – 75
Burner Orifice Diameter (in./drill size)**	0.0820/45	0.0820/45
High Heat		
# of burners (total)	6	8
Rollout switch opens/closes (deg F)	225/175	195/115
Temperature Rise Min – Max (deg F)	30 – 75	45 – 75
Burner Orifice Diameter (in./drill size)**	0.0820/45	0.0820/45
Propane		
Low Heat		
# of burners (total)	3	4
Rollout switch opens/closes (deg F)	195/115	195/115
Temperature Rise Min – Max (deg F)	25 – 70	20 – 60
Burner Orifice Diameter (in./drill size)**	0.0650/52	0.0650/52
Medium Heat		
# of burners (total)	4	6
Rollout switch opens/closes (deg F)	195/115	225/175
Temperature Rise Min – Max (deg F)	20 – 60	30 – 75
Burner Orifice Diameter (in./drill size)**	0.0650/52	0.0650/52
High Heat		
# of burners (total)	6	8
Rollout switch opens/closes (deg F)	225/175	195/115
Temperature Rise Min – Max (deg F)	30 – 75	45 – 75
Burner Orifice Diameter (in./drill size)**	0.0650/52	0.0650/52

** For applications less than 2000 ft elevation.

† PD unit does not support the use of conventional Y1/W1 thermostat

FIOP AND ACCESSORY TABLE

CATEGORY	ITEM	STANDARD FEATURE	OPTION*	ACCESSORY†
Cabinet	Hinged Access Panels	X	X	
	Thru–the–Bottom Connections Gas			X
	Thru–the–Bottom Connections Electrical	X	X	
Coil Options	Copper Fins – condenser coil		X	
	Copper Fins – evaporator and condenser coil		X	
	E–Coat outdoor coil (Al/Cu) and indoor coil (Al/Cu)		X	
	E–Coat outdoor coil (Al/Cu)		X	
	E–Coat outdoor coil (Cu/Cu)		X	
	Pre–Coated Aluminum condenser fins		X	
Condenser Protection	Condenser Coil Grille		X	X
	High Pressure/ Loss of Charge Switch	X		
	Low Pressure/ Loss of Charge Switch	X		
	Evaporator Freeze Protection Switch	X		
Dehumidification and IAQ	Slide Out, Rust Proof, Sloped Condensate Pan	X		
	Foil Faced, Cleanable Insulation	X		
	Demand Control Ventilation CO_2 Sensors			X
	Ultra–Violet Lights			X
	4–Inch Filter Capability	X		
	MERV–8 Filters		X	
Economizers and Outdoor Air	EconoMi$er – OA Temperature (includes barometric relief)		X	X
	EconoMi$er – Single Enthalpy (includes barometric relief)		X	X
	100% Two–Position Damper (motorized)			X
	25% Two–Position Damper (motorized)			X
	Manual Outdoor–Air Damper			X
	Power Exhaust (prop fan)			X
Economizer Sensors	Return Air Temperature Sensor			X
	Return Air Enthalpy Sensor			X
	Outdoor Air Differential Temperature Sensor			X
	Outdoor Air Differential Enthalpy Sensor			X
	Return Air CO_2 Sensor (duct mounted)			X
	Space CO_2 Sensor (wall mounted)			X
Electrical and Controls	*Comfort*Link Communicating Controller	X		X
	HACR Breaker		X	
	Unit–Mounted Non–Fused Disconnect		X	
	Powered Convenience Outlet (load or line side powered)		X	
	Non–Powered Convenience Outlet		X	
	Fan/Filter Status Switches			X
Gas Heat Exchanger	Stainless Steel Heat Exchanger		X	
	Flue Discharge Deflector			X
	Low NOx Heat Exchanger		X	
	LP (liquid propane) Conversion Kit			X
Indoor Motor and Drive	Standard Static Indoor Fan Drive		X	X
	High–Static Indoor Fan Drive		X	
Low Ambient Control	Included with *Comfort*Link™ DDC Communicating Controller	X		
Roof Curbs	Roof Curbs 14" (Vertical or Horizontal Supply/Return)			X
	Roof Curbs 24" (Vertical or Horizontal Supply/Return)			X
	Burglar Bars			X
Thermostats and Sensors	Thermostats are not applicable to this product	N/A	N/A	N/A
	Communicating Space Temperature Sensors with/without over–ride			X
	Relative Humidity Sensor (space, duct or outdoor)			X

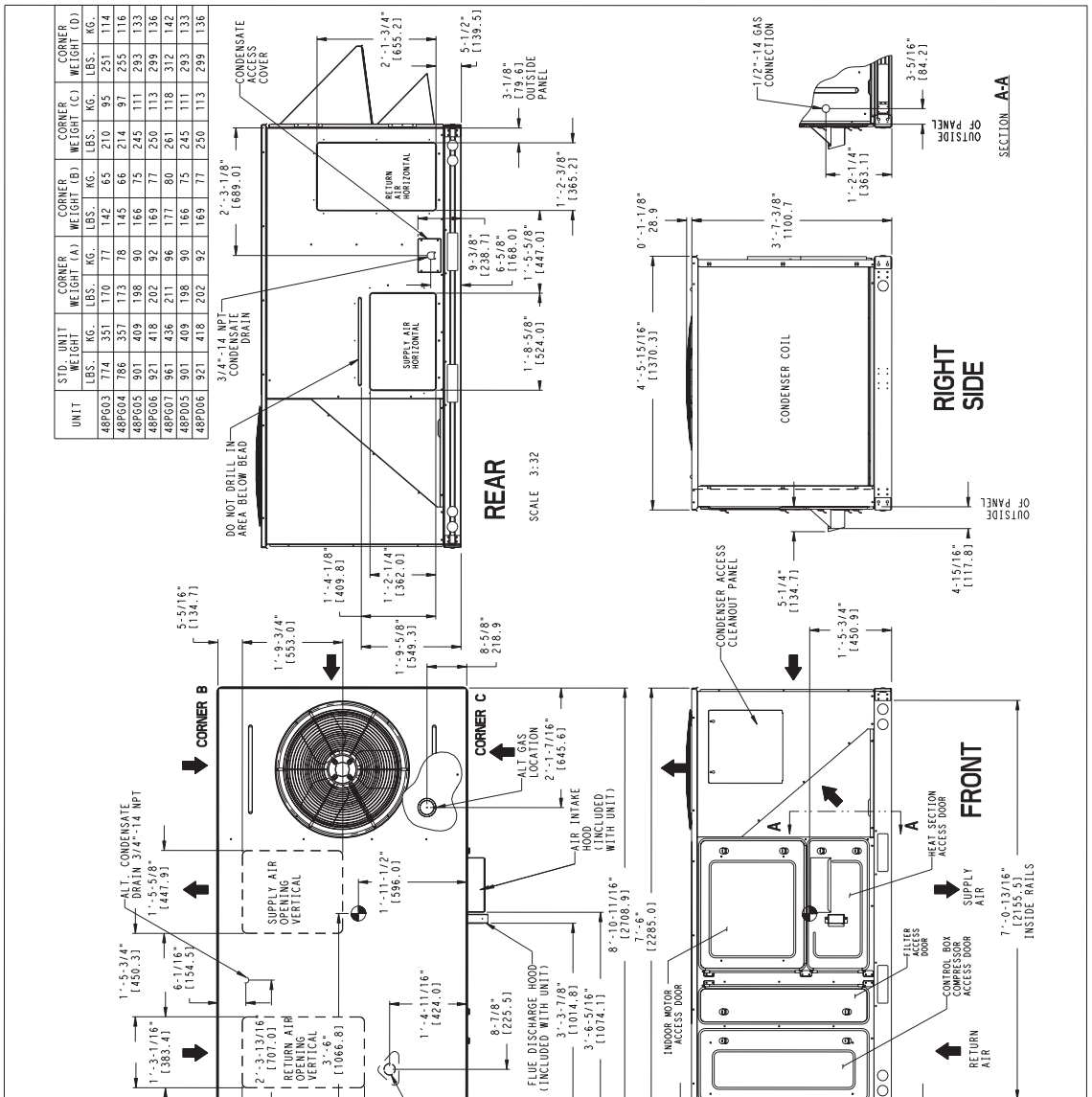
* Factory Installed
† Field Installed

ACCESSORY WEIGHT ADDERS

ACCESSORY WEIGHTS	OPTION/ACCESSORY WEIGHTS			
	05		06	
	lb	kg	lb	kg
2−Position Damper	30	14	30	14
4−in Filter Capability	NO ADDITIONAL WEIGHT			
Barometric Relief Damper	NO ADDITIONAL WEIGHT			
CO_2 Sensor	5	2	5	2
Cu Condenser and Evaporator Coils	175	79	175	79
Cu Condenser Coils	100	45	100	45
Differential Enthalpy Sensor	3	1	3	1
Economizer Horizontal	50	23	50	23
Economizer Vertical	55	25	55	25
Enthalpy Sensor	2	1	2	1
Fan Status	2	1	2	1
Gas Heat − Low	NO ADDITIONAL WEIGHT			
Gas Heat − Medium	15	7	15	7
Gas Heat − High	30	14	30	14
HACR Breaker	20	9	20	9
Hail Guard	50	23	50	23
Manual Damper	30	14	30	14
Non−Fused Disconnect	15	7	15	7
Non−Powered Convenience Outlet	20	9	20	9
Plugged Filter Indicator	2	1	2	1
Power Exhaust	30	14	30	14
Powered Convenience Outlet	35	16	35	16
Return Smoke Detector	5	2	5	2
Roof Curb (14 in.)	145	66	145	66
Roof Curb (24 in.)	155	70	155	70
Supply Smoke Detector	5	2	5	2

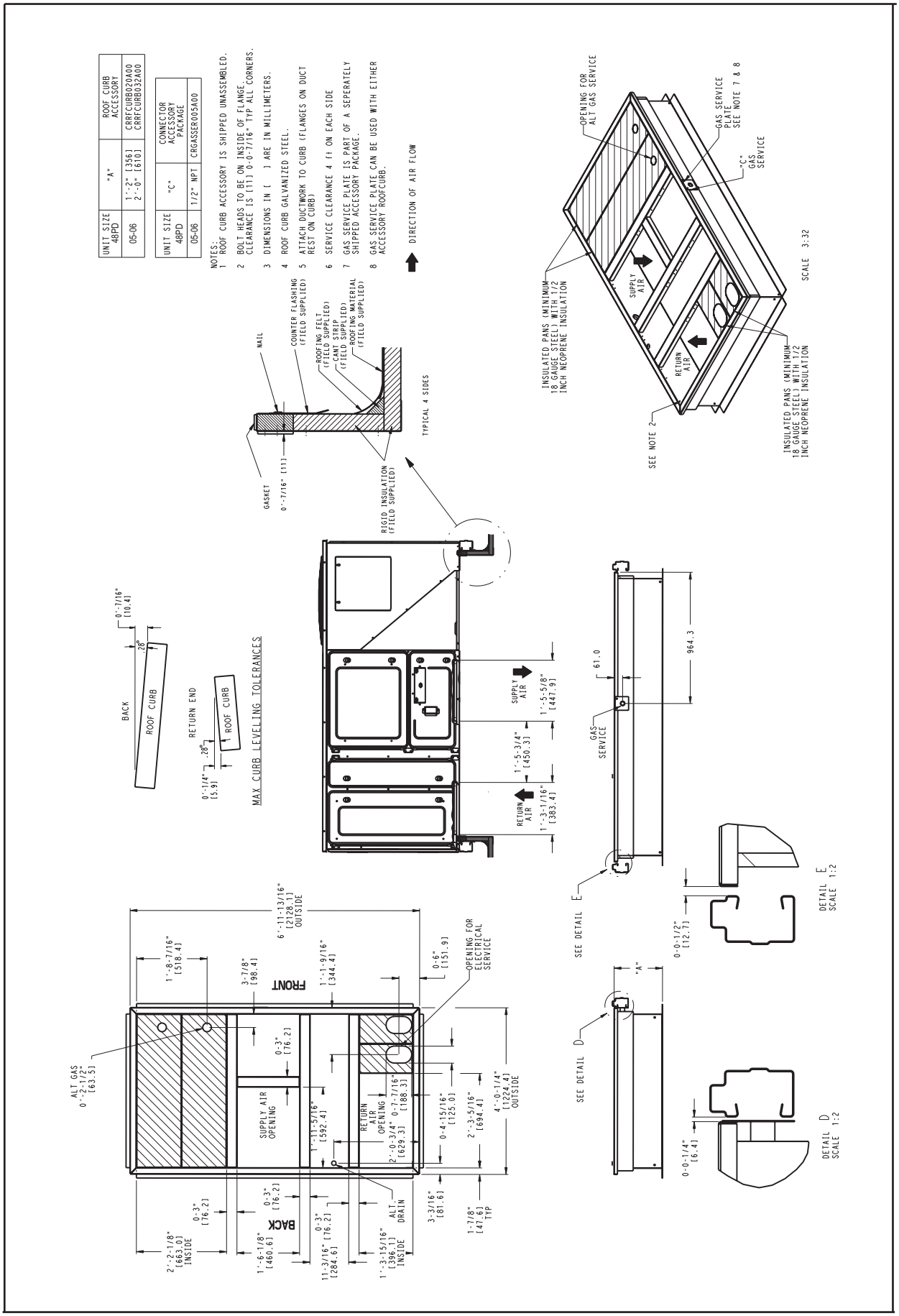
NOTE: All weights do NOT include packaging.

BASE UNIT DIMENSIONS


NOTES:
1. WEIGHTS SHOWN ARE FOR 48PG (HI HEAT) UNIT WITH ALUMINUM COIL AND STANDARD DRIVE. FOR WEIGHTS OF OPTIONAL EQUIPMENT CONSULT PRODUCT DATA BOOK.
2. DO NOT LOCATE ADJACENT UNITS WITH FLUE DISCHARGE FACING ECONOMIZER INLET.
3. MINIMUM CLEARANCE (LOCAL CODES OR JUSISDICTIONS MAY PREVAIL):
a. FRONT 48 INCHES TO COMBUSTIBLE SURFACES (18 INCHES WHEN USING ACCESSORY FLUE DISCHARGE DEFLECTOR).
b. WHEN NOT USING ROOF CURB (1 INCH) BOTTOM OF BASE PAN TO COMBUSTIBLE SURFACES
c. WHEN NOT USING ROOF CURB (0 INCHES) TO BOTTOM OF BASE RAIL RIGHT SIDE, FRONT AND BACK SIDES (36 INCHES) FOR PROPER CONDENSER AIRFLOW.
d. OVERHEAD (60 INCHES) TO ASSURE PROPER CONDENSER AIRFLOW.
e. BETWEEN UNITS CONTROL BOX SIDES, 42 IN. PER NEC.
f. BETWEEN UNIT AND UNGROUNDED SURFACE CONTROL BOX SIDE (36 INCHES PER NEC)
g. BETWEEN UNIT AND BLOCK OF CONCRETE WALL AND OTHER GROUNDED SURFACES CONTROL BOX SIDE (42 INCHES) PER NEC.
h. CLEARANCE IN FRONT OF INDOOR MOTOR ACCESS FOR BLOWER SLED
i. CLEARANCE FOR COMPLETE CONDENSATE PAN REMOVAL 4'6".
j. ON UNITS WITH ECONOMIZER ALLOW 3'6" FROM LEFT SIDE FOR SERVICE ACCESS TO ECONOMIZER.
k. HORIZONTAL SUPPLY AND RETURN.(0 INCHES)
4. DOWN SHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THE DUCTS MUST BE SUPPORTED BY CROSS BRACES AS DONE ON ACCESSORY ROOF CURB.
5. DIMENSIONS IN ( ) ARE IN MILLIMETERS OR KILOGRAMS.
6. WITH THE EXCEPTION OF CLEARANCE FOR THE CONDENSER COIL. COMBUSTIBLE SURFACES AND THE DAMPER/POWER EXHAUST AS STATED IN NOTE #2. A REMOVABLE FENCE OR BARRICADE REQUIRES NO CLEARANCE.
7. DIMENSIONS ARE FROM OUTSIDE OF BASE RAIL. ALLOW 0˝-5/16 (8) ON EACH SIDE FOR TOP COVER DRIP EDGE.
8. UNITS MAY BE INSTALLED ON COMBUSTIBLE FLOORS MADE FROM CLASS A,B,C ROOF COVERING MATERIAL IF SET ON BASE RAILS.
CENTER OF GRAVITY
DIRECTION OF AIR FLOW
UNIT | STD. UNIT WEIGHT | CORNER WEIGHT (A) | CORNER WEIGHT (B) | CORNER WEIGHT (C) | CORNER WEIGHT (D)
LBS. KG. | LBS. KG. | LBS. KG. | LBS. KG. | LBS. KG.
48PG03 774 351 | 170 77 | 142 65 | 210 95 | 251 114
48PG04 786 357 | 173 78 | 145 66 | 214 97 | 255 116
48PG05 901 409 | 198 90 | 166 75 | 245 111 | 293 133
48PG06 921 418 | 202 92 | 169 77 | 250 113 | 299 136
48PG07 961 436 | 211 96 | 177 80 | 261 118 | 312 142
48PD05 901 409 | 198 90 | 166 75 | 245 111 | 293 133
48PD06 921 418 | 202 92 | 169 77 | 250 113 | 299 136
REAR
SCALE 3:32
DO NOT DRILL IN AREA BELOW BEAD
3/4"-14 NPT CONDENSATE DRAIN
SUPPLY AIR HORIZONTAL
RETURN HORIZONTAL
CONDENSATE ACCESS COVER
OUTSIDE PANEL
RIGHT SIDE
CONDENSER COIL
CONDENSER ACCESS CLEANOUT PANEL
SECTION A-A
1/2"-14 GAS CONNECTION
LEFT SIDE
CONVENIENCE OUTLET HACR BREAKER (OPTIONS)
DISCONNECT
OUTSIDE AIR HOOD (HOOD FIELD INSTALLED) (INCLUDED WITH UNIT)
LOW VOLTAGE Ø0-7/8" 22.4
POWER SUPPLY ACCESS COVER
BAROMETRIC RELIEF HOOD (INCLUDED WITH UNIT) POWER EXHAUST OPERATING POSITION (OPTION)
FRONT
INDOOR MOTOR ACCESS DOOR
HEAT SECTION ACCESS DOOR
SUPPLY AIR
FILTER ACCESS DOOR
CONTROL BOX COMPRESSOR ACCESS DOOR
RETURN AIR
CORNER A
CORNER B
CORNER C
CORNER D
SUPPLY AIR OPENING VERTICAL
RETURN AIR OPENING VERTICAL
ALT. CONDENSATE DRAIN 3/4"-14 NPT
ALT GAS LOCATION
AIR INTAKE HOOD (INCLUDED WITH UNIT)
FLUE DISCHARGE HOOD (INCLUDED WITH UNIT)
3/4" DIA [19.1] POWER SUPPLY KNOCKOUT (THRU CURB)

C08493

ROOF CURB



C07313

SELECTION PROCEDURE

I. **Determine cooling and heating requirements at design conditions**.

Given the following data:

- Vertical or horizontal supply/return configuration
- Evaporator air quantity (CFM)
- External duct static pressure (in.wg)
- Electrical characteristics (Volts-Ph-Hz)

- Cooling
  - . . . Required gross cooling capacity (TC)
  - . . . Gross sensible capacity (SHC)
  - . . . Condenser entering air temperature (OATc)
  - . . . Indoor air (return air) temperature (RATc)
- Heating
  - . . . Required heating capacity (HC)
  - . . . Ambient air temperature (OATh)
  - . . . Condenser entering air temperature (OATh)
  - . . . Indoor air (return air) temperature (RATh)

II. **Select unit size**.

The unit size should be based on required cooling capacity at design conditions.

1. Using the design cooling data, enter the cooling capacity table (or software selection program) and determine the unit Total Cooling and Sensible Cooling Capacities.
2. Compare unit performance to required TC and SHC values.

- **NOTE**: Unit ratings are gross capacities and do not include the effect of indoor fan motor heat. To calculate net capacities, see Step V.

III. **Select heating capacity**

The unit heat option should be chosen to meet the heating requirements at the design conditions.

1. For gas heat units, utilize heat output values from the Gas Heating Capacities and Efficiencies table. Compare the heating output value to the design criteria. Calculate the heating leaving air temperature value using the formula:
   EAT = (% RA)(RATh) + (%OA)(OATh)
   Heat Output in BTU = (CFM)(1.08)(EAT – LAT)

IV. **Determine fan speed and power requirements at design conditions**.

48PD units use the same fan performance tables as the similar size PG units. The variable fan system for a PD unit uses the 100% fan speed to satisfy the design cooling & heating capacities (same fan speed). The unit will modulate the fan system to lower speeds from that setting. See unit Application Data and Sequence of Operation sections of this manual for additional information.

1. Before entering the Fan Performance tables, calculate the total static pressure required due to duct design and any selected options/accessories.
2. Tabulated fan performance includes unit casing, filters, and wet evaporator coil. User only has to add effect of duct static pressure and options/accessories added to base unit. If using the software selection program, the options/accessory static pressure effects are automatically added in the selection software, so user only has to determine the appropriate duct static pressure.
3. Enter Fan Performance tables for the appropriate unit and determine the fan speed (RPM) and horsepower (bhp).
4. Compare fan speed and motor horsepower to speed ranges of each drive per the fan tables. If using the software selection program and more than one option is compatible with the desired operating point, the program will automatically default to the lower cost option.

V. **Determine net cooling capacities**.

Listed cooling capacities are gross capacities and do not include indoor fan motor (IFM) heat. When desired, calculate the net cooling capacity as follows:

1. Determine input power to the motor, by entering the Fan Performance tables and determining the motor calculated input watts:
   Input Watts = (746 x Bhp)/(motor eff)
2. Determine net cooling capacity and net sensible cooling capacity using the following formulas:
   IFM Heat = Input Watts x 3.412 Btuh/Watt
   Net Capacity = Gross Capacity - IFM Heat

VI. **Select compatible controls and sensors**.

The 48PD units cannot be operated using a conventional Y1/Y2 thermostat. A space temperature sensor must be used with or without a humidity or CO_2 input.

NOTE:

1. Unit design selection should be chosen with consideration for the design maximum cooling & heating conditions. Because the PD units use a modulating fan and modulating compressor system, an infinite range of part-load cooling performance is available. The part-load cooling capacity will modulate to the specific requirements of the zone as called for by the zone requirements.
2. The unit selection and initial unit configuration must be made with the unit's 100% airflow configuration in the nominal unit range of 300-500 cfm/nominal ton. This is necessary to in order for the *Comfort*Link™ control logic to properly control the unit.
3. Economizer minimum damper position is automatically adjusted by the unit's *Comfort*Link controls as the indoor fan speed changes, in order to ensure the Outdoor Ventilation Air does not fall below the desired setpoint.

MAXIMUM COOLING CAPACITY

48PD05																						
Temp (F) Air Ent Condenser (Edb)		Air Entering Evaporator — Cfm																				
		1200							1600							2000						
		Air Entering Evaporator — Ewb (F)																				
		80	76	72	67	62	58	54	80	76	72	67	62	58	54	80	76	72	67	62	58	54
60	TC	66.6	62.4	58.4	53.6	49.1	45.7	44.5	70.5	66.2	61.9	57.0	52.3	49.2	49.2	72.9	68.3	64.1	59.1	54.3	52.7	52.7
	SHC	18.3	23.4	27.8	33.8	39.6	43.4	44.5	18.6	24.3	31.0	38.6	45.8	49.2	49.2	18.7	26.1	33.7	42.7	51.0	52.7	52.7
	BF	0.00	0.00	0.00	0.24	0.22	0.23	0.37	0.00	0.00	0.27	0.23	0.23	0.30	0.47	0.00	0.00	0.26	0.24	0.25	0.39	0.55
70	TC	64.4	60.3	56.4	51.8	47.5	44.1	43.3	67.9	63.6	59.5	54.8	50.4	47.8	47.8	70.0	65.6	61.6	56.8	52.1	51.1	51.1
	SHC	17.6	22.6	27.2	33.2	38.9	42.3	43.3	17.8	23.7	30.2	37.8	45.1	47.8	47.8	17.9	25.3	32.8	41.9	49.7	51.1	51.1
	BF	0.00	0.00	0.36	0.22	0.20	0.24	0.39	0.00	0.00	0.25	0.22	0.22	0.31	0.49	0.00	0.36	0.25	0.24	0.26	0.41	0.56
75	TC	63.2	59.1	55.4	50.8	46.6	43.4	42.7	66.4	62.3	58.3	53.7	49.4	47.0	47.0	68.4	64.1	60.2	55.6	51.1	50.3	50.3
	SHC	17.2	22.2	26.9	32.8	38.6	41.8	42.7	17.4	23.4	29.8	37.3	44.7	47.0	47.0	17.5	24.9	32.4	41.4	49.1	50.3	50.3
	BF	0.00	0.00	0.29	0.22	0.20	0.24	0.40	0.00	0.00	0.24	0.22	0.22	0.33	0.50	0.00	0.33	0.25	0.24	0.27	0.42	0.57
85	TC	60.6	56.7	53.1	48.8	44.7	41.7	41.3	63.5	59.5	55.7	51.4	47.2	45.4	45.4	65.3	61.2	57.5	53.1	49.0	48.5	48.5
	SHC	16.3	21.3	26.1	32.0	37.7	40.3	41.3	16.5	22.6	28.9	36.5	43.6	45.4	45.4	16.6	24.0	31.4	40.5	47.6	48.5	48.5
	BF	0.00	0.00	0.26	0.20	0.19	0.27	0.41	0.00	0.00	0.23	0.21	0.22	0.35	0.51	0.00	0.30	0.24	0.23	0.28	0.44	0.58
95	TC	57.9	54.2	50.7	46.6	42.7	39.9	39.9	60.4	56.5	53.1	48.9	44.9	43.7	43.7	62.0	58.1	54.6	50.5	46.6	46.5	46.6
	SHC	15.5	20.1	25.2	31.2	36.8	39.9	39.9	15.6	21.7	28.0	35.5	42.4	43.7	43.7	15.7	23.1	30.5	39.5	46.6	46.5	46.6
	BF	0.00	0.00	0.23	0.19	0.19	0.24	0.43	0.00	0.36	0.22	0.21	0.22	0.37	0.53	0.00	0.27	0.23	0.23	0.28	0.46	0.60
105	TC	54.8	51.4	48.0	44.2	41.9	38.3	38.3	57.0	53.4	50.2	46.3	42.6	41.9	41.9	58.3	54.8	51.6	47.7	44.5	44.5	44.5
	SHC	14.5	19.1	24.3	30.2	31.0	38.3	38.3	14.6	20.8	27.0	34.5	41.0	41.9	41.9	14.7	22.1	29.5	38.4	44.2	44.5	44.5
	BF	0.00	0.00	0.21	0.18	0.18	0.27	0.45	0.00	0.28	0.21	0.21	0.23	0.40	0.55	0.00	0.26	0.23	0.23	0.32	0.48	0.61
115	TC	51.3	48.2	45.2	41.6	38.3	36.6	36.6	53.2	50.0	47.1	43.5	40.2	39.9	39.9	54.3	51.2	48.3	44.7	42.2	42.2	42.2
	SHC	13.5	18.3	23.2	29.2	34.9	36.6	36.6	13.5	19.7	25.9	33.4	39.3	39.9	39.9	13.6	21.0	28.3	37.3	42.2	42.2	42.2
	BF	0.00	0.00	0.19	0.18	0.18	0.30	0.48	0.00	0.24	0.21	0.20	0.26	0.42	0.57	0.00	0.24	0.23	0.23	0.34	0.51	0.63
125	TC	47.4	44.5	41.9	38.7	35.7	34.6	34.6	48.9	46.0	43.4	40.3	37.5	37.5	37.5	49.9	47.0	44.5	41.3	39.5	39.5	39.5
	SHC	12.3	17.2	22.1	28.0	33.5	34.6	34.6	12.3	18.6	24.7	32.2	37.5	37.5	37.5	12.4	19.8	27.1	35.9	39.5	39.5	39.5
	BF	0.00	0.26	0.18	0.17	0.18	0.34	0.50	0.00	0.22	0.20	0.20	0.27	0.46	0.59	0.01	0.23	0.22	0.23	0.38	0.54	0.66

LEGEND

BF – Bypass Factor
Edb – Entering Dry–Bulb
Ewb – Entering Wet–Bulb
kW – Compressor Motor Power Input
Idb – Leaving Dry–Bulb
Iwb – Leaving Wet–Bulb
SHC – Sensible Heat Capacity (1000 Btuh) Gross
TC – Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet–bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil

3. The SHC is based on 80°F edb temperature of air entering evaporator coil
   Below 80°F edb, subtract (corr factor x cfm) from SHC.
   Above 80°F edb, add (corr factor x cfm) to SHC.

BYPASS FACTOR (BF)	ENTERING AIR DRY-BULB TEMP (F)					
	79	78	77	76	75	under 75
	81	82	83	84	85	over 85
	Correction Factor					
.05	1.04	2.07	3.11	4.14	5.18	Use formula shown below.
.10	.98	1.96	2.94	3.92	4.90	
.20	.87	1.74	2.62	3.49	4.36	
.30	.76	1.53	2.29	3.05	3.82	

Interpolation is permissible.

Correlation Factor = 1.09 x (1–BF) x (edb – 80).

4. Cooling capacities for 48PG03–16 units with Humidi–MiZer system in Cooling mode are the same as standard units.

MAXIMUM COOLING CAPACITY (CONT)

48PD06																			
Temp (F) Air Ent Condenser (Edb)		Air Entering Evaporator — Cfm																	
		1200						2000						2500					
		Air Entering Evaporator — Ewb (F)																	
		80	72	67	62	58	54	80	72	67	62	58	54	80	72	67	62	58	54
60	TC	83.9	73.6	67.9	62.6	58.8	57.3	88.6	78.1	72.0	66.7	63.2	63.2	91.2	80.8	74.9	69.4	67.6	67.6
	SHC	23.0	35.7	43.4	51.1	55.7	57.2	23.4	39.9	49.6	59.3	63.1	63.1	23.5	43.2	55.3	65.6	67.5	67.5
	BF	0.00	0.17	0.16	0.16	0.20	0.37	0.00	0.17	0.17	0.18	0.29	0.47	0.00	0.20	0.19	0.22	0.39	0.55
70	TC	81.1	71.3	65.8	60.6	56.7	55.7	85.4	75.4	69.4	64.4	61.4	61.5	87.8	78.0	72.2	67.0	65.8	65.7
	SHC	22.1	34.9	42.6	50.1	54.2	55.6	22.5	38.8	48.6	58.1	61.4	61.4	22.6	42.2	54.2	64.1	65.7	65.7
	BF	0.00	0.16	0.16	0.16	0.21	0.39	0.00	0.17	0.17	0.18	0.31	0.49	0.00	0.20	0.19	0.23	0.41	0.56
75	TC	79.9	70.1	64.7	59.5	55.6	54.8	83.8	73.9	68.1	63.2	60.6	60.6	85.9	76.4	70.8	65.7	64.8	64.8
	SHC	21.7	34.4	42.1	49.4	53.6	54.8	22.0	38.3	48.1	57.5	60.5	60.5	22.0	41.7	53.6	63.3	64.7	64.7
	BF	0.00	0.16	0.16	0.16	0.21	0.40	0.00	0.17	0.17	0.18	0.32	0.50	0.00	0.20	0.19	0.24	0.42	0.57
85	TC	76.9	67.5	62.2	57.2	53.7	53.3	80.3	70.9	65.4	60.6	58.6	58.6	82.0	73.2	67.8	63.0	62.5	62.5
	SHC	20.8	33.5	41.1	48.7	52.0	53.2	21.0	37.2	46.8	56.0	58.5	58.6	20.9	40.6	52.3	61.4	62.5	62.5
	BF	0.00	0.15	0.15	0.15	0.23	0.42	0.00	0.17	0.18	0.19	0.34	0.52	0.00	0.20	0.20	0.25	0.44	0.58
95	TC	73.6	64.5	59.5	54.8	51.5	51.5	76.4	67.7	62.4	57.9	56.5	56.5	77.9	69.7	64.6	60.1	60.1	60.1
	SHC	19.7	32.4	40.1	47.4	51.4	51.4	19.8	36.1	45.9	54.6	56.4	56.4	19.8	39.4	51.2	60.0	60.0	60.1
	BF	0.00	0.15	0.15	0.16	0.23	0.44	0.00	0.17	0.17	0.20	0.37	0.53	0.00	0.20	0.19	0.26	0.46	0.60
105	TC	69.8	61.3	56.6	52.1	49.4	49.3	72.1	64.2	59.2	55.0	54.1	54.1	73.3	66.0	61.2	57.7	57.4	57.5
	SHC	18.6	31.2	38.9	46.2	49.3	49.3	18.6	34.8	44.6	52.8	54.1	54.1	18.5	38.1	49.9	56.2	57.4	57.4
	BF	0.00	0.15	0.15	0.15	0.26	0.46	0.00	0.17	0.17	0.21	0.39	0.55	0.00	0.20	0.20	0.31	0.48	0.62
115	TC	65.6	57.8	53.4	49.0	47.0	47.1	67.4	60.3	55.8	51.8	51.5	51.4	68.3	61.9	57.5	54.5	54.6	54.6
	SHC	17.3	30.0	37.7	44.8	47.0	47.0	17.3	33.5	43.2	50.5	51.4	51.4	17.2	36.7	48.4	54.5	54.5	54.5
	BF	0.00	0.15	0.14	0.15	0.30	0.49	0.00	0.17	0.17	0.23	0.42	0.57	0.00	0.20	0.20	0.33	0.51	0.64
125	TC	60.8	53.8	49.7	45.7	44.5	44.5	62.0	56.0	51.7	48.4	48.4	48.4	62.6	57.4	53.3	51.0	51.1	51.1
	SHC	15.9	28.5	36.1	42.9	44.4	44.5	15.8	32.0	41.6	47.8	48.3	48.3	15.6	35.0	46.7	51.0	51.0	51.0
	BF	0.00	0.15	0.14	0.17	0.34	0.51	0.00	0.18	0.17	0.27	0.46	0.60	0.00	0.21	0.20	0.38	0.54	0.66

LEGEND

BF – Bypass Factor
Edb – Entering Dry–Bulb
Ewb – Entering Wet–Bulb
kW – Compressor Motor Power Input
ldb – Leaving Dry–Bulb
lwb – Leaving Wet–Bulb
SHC – Sensible Heat Capacity (1000 Btuh) Gross
TC – Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet–bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil

3. The SHC is based on 80°F edb temperature of air entering evaporator coil Below 80°F edb, subtract (corr factor x cfm) from SHC.
Above 80°F edb, add (corr factor x cfm) to SHC.

BYPASS FACTOR (BF)	ENTERING AIR DRY-BULB TEMP (F)					
	79	78	77	76	75	under 75
	81	82	83	84	85	over 85
	Correction Factor					
.05	1.04	2.07	3.11	4.14	5.18	Use formula shown below.
.10	.98	1.96	2.94	3.92	4.90	
.20	.87	1.74	2.62	3.49	4.36	
.30	.76	1.53	2.29	3.05	3.82	

Interpolation is permissible.
Correlation Factor = 1.09 x (1–BF) x (edb – 80).

FAN PERFORMANCE

Vertical Supply/Return

48PD05 (High Heat Units)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	520	0.17	628	0.24	723	0.33	811	0.41	892	0.51
1300	545	0.20	648	0.28	739	0.37	823	0.46	902	0.56
1400	570	0.24	668	0.32	756	0.41	837	0.51	913	0.61
1500	596	0.28	691	0.37	775	0.46	853	0.56	927	0.67
1600	623	0.32	714	0.42	795	0.52	870	0.62	942	0.73
1700	650	0.37	737	0.48	816	0.58	889	0.69	958	0.80
1800	677	0.43	762	0.54	838	0.65	909	0.76	976	0.88
1900	705	0.50	787	0.61	861	0.72	929	0.84	994	0.97
2000	734	0.57	813	0.68	884	0.80	951	0.93	1014	1.06

48PD05 (High Heat Units) (cont)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	968	0.61	1040	0.71	1108	0.82	1172	0.93	1233	1.04
1300	976	0.66	1046	0.77	1112	0.88	1176	1.00	1237	1.11
1400	985	0.72	1054	0.83	1119	0.95	1181	1.07	1241	1.19
1500	996	0.78	1063	0.90	1127	1.02	1188	1.14	1247	1.27
1600	1009	0.85	1074	0.97	1136	1.09	1196	1.22	1254	1.35
1700	1024	0.92	1087	1.05	1147	1.17	1205	1.31	1262	1.44
1800	1039	1.00	1100	1.13	1159	1.26	1216	1.40	1272	1.54
1900	1056	1.09	1116	1.22	1173	1.36	1229	1.50	1283	1.64
2000	1074	1.19	1132	1.32	1188	1.46	1242	1.61	1295	1.75

LEGEND

Bhp – Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 596 to 910 rpm for low range motor/drive and 828 to 1173 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 0.85 for low range motor/drive and 1.60 (single phase) and 2.40 (3 phase) for high range motor/drive.
3. See General Fan Performance Notes.

48PD06 (High Heat Units)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	620	0.30	711	0.39	794	0.49	871	0.59	944	0.70
1600	648	0.35	736	0.45	816	0.55	890	0.65	960	0.76
1700	677	0.40	762	0.51	838	0.61	910	0.72	978	0.84
1800	707	0.47	788	0.58	862	0.69	931	0.80	997	0.92
1900	737	0.54	815	0.65	887	0.77	954	0.89	1017	1.01
2000	767	0.61	843	0.73	912	0.85	977	0.98	1039	1.11
2100	798	0.70	871	0.82	938	0.95	1001	1.08	1061	1.21
2200	829	0.79	900	0.92	965	1.05	1026	1.19	1084	1.33
2300	861	0.89	929	1.03	992	1.17	1052	1.31	1108	1.45
2400	893	1.00	959	1.15	1020	1.29	1078	1.43	1133	1.58
2500	925	1.12	989	1.27	1048	1.42	1105	1.57	1158	1.72

48PD06 (High Heat Units) (cont)

AIRFLOW (CFM)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	1013	0.81	1078	0.92	1141	1.05	1202	1.17	1260	1.30
1600	1027	0.88	1091	1.00	1152	1.13	1211	1.25	1269	1.39
1700	1043	0.96	1105	1.08	1165	1.21	1222	1.35	1278	1.48
1800	1060	1.05	1120	1.18	1179	1.31	1235	1.44	1290	1.59
1900	1078	1.14	1137	1.27	1194	1.41	1249	1.55	1302	1.70
2000	1098	1.24	1155	1.38	1210	1.52	1264	1.67	1316	1.81
2100	1119	1.35	1174	1.49	1228	1.64	1280	1.79	1331	1.94
2200	1140	1.47	1195	1.62	1247	1.77	1298	1.92	1348	2.08
2300	1163	1.60	1216	1.75	1267	1.90	1317	2.06	1365	2.22
2400	1186	1.73	1238	1.89	1288	2.05	1336	2.21	1384	2.37
2500	1210	1.88	1261	2.04	1309	2.20	1357	2.37	—	—

LEGEND

Bhp – Brake Horsepower

NOTES:

1. Motor drive range is 690 to 978 rpm for low range motor/drive and 929 to 1261 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 0.85 (single phase) and 2.40 (3 phase) for low range motor/drive and 1.60 (single phase) and 2.40 (3 phase) for high range motor/drive.
3. See General Fan Performance Notes.

FAN PERFORMANCE (CONT)

Horizontal Supply/Return

48PD05 (High Heat Units)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	456	0.13	574	0.20	675	0.28	766	0.37	850	0.46
1300	477	0.16	591	0.23	688	0.32	776	0.41	857	0.50
1400	500	0.18	610	0.27	703	0.36	788	0.45	867	0.55
1500	524	0.22	630	0.31	720	0.40	802	0.50	879	0.60
1600	550	0.26	652	0.35	739	0.45	819	0.55	893	0.66
1700	576	0.30	675	0.40	759	0.50	836	0.61	908	0.72
1800	604	0.35	699	0.46	781	0.57	856	0.68	925	0.79
1900	633	0.41	724	0.52	804	0.63	876	0.75	944	0.87
2000	662	0.47	750	0.59	828	0.71	898	0.83	964	0.95

48PD05 (High Heat Units) (cont)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	929	0.56	1003	0.66	1073	0.76	1139	0.87	1202	0.98
1300	934	0.60	1006	0.71	1075	0.82	1140	0.93	1202	1.05
1400	941	0.65	1012	0.76	1079	0.87	1143	0.99	1204	1.11
1500	951	0.71	1020	0.82	1085	0.94	1148	1.06	1208	1.18
1600	963	0.77	1029	0.89	1093	1.01	1155	1.13	1214	1.26
1700	976	0.84	1041	0.96	1103	1.08	1163	1.21	1221	1.34
1800	991	0.91	1054	1.04	1115	1.16	1174	1.30	1230	1.43
1900	1008	0.99	1070	1.12	1129	1.25	1186	1.39	1241	1.53
2000	1026	1.08	1086	1.21	1144	1.35	1199	1.49	1253	1.63

LEGEND

Bhp – Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 596 to 910 for low range motor/drive and 828 to 1173 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 0.85 for low range motor/drive and 1.60 (single phase) and 2.40 (3 phase) for high range motor/drive.
3. See General Fan Performance Notes.

48PD06 (High Heat Units)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	551	0.24	653	0.33	741	0.42	821	0.52	896	0.62
1600	579	0.28	676	0.38	761	0.48	839	0.58	912	0.69
1700	608	0.33	701	0.43	783	0.54	858	0.64	929	0.76
1800	638	0.39	727	0.49	807	0.60	879	0.71	948	0.83
1900	668	0.45	755	0.56	831	0.68	902	0.79	968	0.91
2000	700	0.52	783	0.64	857	0.76	925	0.88	990	1.01
2100	732	0.60	812	0.72	884	0.85	950	0.97	1013	1.11
2200	765	0.68	842	0.81	912	0.95	976	1.08	1037	1.21
2300	799	0.78	873	0.92	940	1.05	1002	1.19	1062	1.33
2400	833	0.88	904	1.03	969	1.17	1030	1.31	1087	1.46
2500	867	1.00	936	1.15	999	1.30	1058	1.44	1114	1.60

48PD06 (High Heat Units) (cont)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	968	0.73	1035	0.85	1100	0.97	1162	1.09	1222	1.21
1600	981	0.80	1047	0.92	1110	1.04	1171	1.16	1229	1.29
1700	996	0.87	1060	0.99	1121	1.12	1181	1.25	1238	1.38
1800	1013	0.95	1075	1.08	1135	1.21	1193	1.34	1248	1.48
1900	1031	1.04	1092	1.17	1150	1.30	1206	1.44	1261	1.58
2000	1051	1.14	1110	1.27	1166	1.41	1221	1.55	1275	1.69
2100	1072	1.24	1129	1.38	1185	1.52	1238	1.67	1290	1.82
2200	1094	1.35	1150	1.50	1204	1.64	1256	1.79	1307	1.95
2300	1118	1.48	1172	1.62	1225	1.77	1275	1.93	1325	2.09
2400	1142	1.61	1195	1.76	1246	1.92	1296	2.07	1344	2.24
2500	1168	1.75	1219	1.91	1269	2.07	1317	2.23	1365	2.40

LEGEND

Bhp – Brake Horsepower

NOTES:

1. Motor drive range is 690 to 978 for low range motor/drive and 929 to 1261 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 0.85 (single phase) and 2.40 (3 phase) for low range motor/drive and 1.60 (single phase) and 2.40 (3 phase) for high range motor/drive.
3. See General Fan Performance Notes.

GENERAL NOTES FOR FAN PERFORMANCE DATA TABLES

1. Static pressure losses from accessories and options (Humidi-MiZer™ system, economizer, etc.) must be added to external static pressure before entering Fan Performance table.
2. Interpolation is permissible. Do not extrapolate.
3. Fan performance is based on wet coils, clean filters, and casing losses. See Accessory/FIOP Static Pressure information.
4. Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
5. Use of a field-supplied motor may affect wire size. Recalculate the unit power supply MCA and MOCP if required. Contact your Carrier representative for details.
6. Use the following formula to calculate input watts:

   Input Watts = Bhp x (746/Motor Eff)

INDOOR FAN DATA

48PD Fan Motor and Drive Data – Vertical Supply/Return		
UNIT SIZE	**05**	**06**
Voltage	**208/230 and 460**	**208/230 and 460**
LOW STATIC DRIVE OPTION		
Motor HP	2.4	2.4
Motor Nominal RPM	1725	1725
Maximum Continuous BHP	2.0	2.0
Maximum Continuous Watts	2000	2000
Motor Frame Size	56HZ	56HZ
Motor Shaft Diameter (in.)	5/8	5/8
Motor Pulley Pitch Diameter Min–Max (in.)	1.9 – 2.9	2.4–3.4
Fan RPM Range	596–910	690–978
Blower Pulley Pitch Diameter (in.)	5.5	6.0
Pulley Center Line Distance (in.)	16.2–20.2	16.2–20.2
Belt Quantity–Type–Pitch Length (in.)	1–AX48–49.3	1–AX48–49.3
Speed Change per Turn of Adjustable Pulley (RPM)	63	58
Moveable Pulley Maximum Full Turns	5	5
Factory Speed Setting (RPM)	596	690
HIGH STATIC DRIVE OPTION		
Motor HP	2.4	2.4
Motor Nominal RPM	1725	1725
Maximum Continuous BHP	2.0	2.0
Maximum Continuous Watts	2000	2000
Motor Frame Size	56HZ	56HZ
Motor Shaft Diameter (in.)	5/8	5/8
Motor Pulley Pitch Diameter Min–Max (in.)	2.4–3.4	2.8–3.8
Fan RPM Range	828–1173	929–1261
Blower Pulley Pitch Diameter (in.)	5.0	5.2
Pulley Center Line Distance (in.)	16.2–20.2	16.2–20.2
Belt Quantity–Type–Pitch Length (in.)	1–AX48–49.3	1–AX48–49.3
Speed Change per Turn of Adjustable Pulley (RPM)	69	67
Moveable Pulley Maximum Full Turns	5	5
Factory Speed Setting (RPM)	828	929

48PD Fan Motor and Drive Data – Horizontal Supply/Return		
UNIT SIZE	**05**	**06**
Voltage	**208/230 and 460**	**208/230 and 460**
LOW STATIC DRIVE OPTION		
Motor HP	2.4	2.4
Motor Nominal RPM	1725	1725
Maximum Continuous BHP	2.0	2.0
Maximum Continuous Watts	2000	2000
Motor Frame Size	56HZ	56HZ
Motor Shaft Diameter (in.)	5/8	5/8
Motor Pulley Pitch Diameter Min–Max (in.)	1.9 – 2.9	2.4–3.4
Fan RPM Range	596–910	690–978
Blower Pulley Pitch Diameter (in.)	5.5	6.0
Pulley Center Line Distance (in.)	16.2–20.2	16.2–20.2
Belt Quantity–Type–Pitch Length (in.)	1–AX48–49.3	1–AX48–49.3
Speed Change per Turn of Adjustable Pulley (RPM)	63	58
Moveable Pulley Maximum Full Turns	5	5
Factory Speed Setting (RPM)	596	690
HIGH STATIC DRIVE OPTION		
Motor HP	2.4	2.4
Motor Nominal RPM	1725	1725
Maximum Continuous BHP	2.0	2.0
Maximum Continuous Watts	2000	2000
Motor Frame Size	56HZ	56HZ
Motor Shaft Diameter (in.)	5/8	5/8
Motor Pulley Pitch Diameter Min–Max (in.)	2.4–3.4	2.8–3.8
Fan RPM Range	828–1173	929–1261
Blower Pulley Pitch Diameter (in.)	5.0	5.2
Pulley Center Line Distance (in.)	16.2–20.2	16.2–20.2
Belt Quantity–Type–Pitch Length (in.)	1–AX48–49.3	1–AX48–49.3
Speed Change per Turn of Adjustable Pulley (RPM)	69	67
Moveable Pulley Maximum Full Turns	5	5
Factory Speed Setting (RPM)	828	929

ELECTRICAL DATA

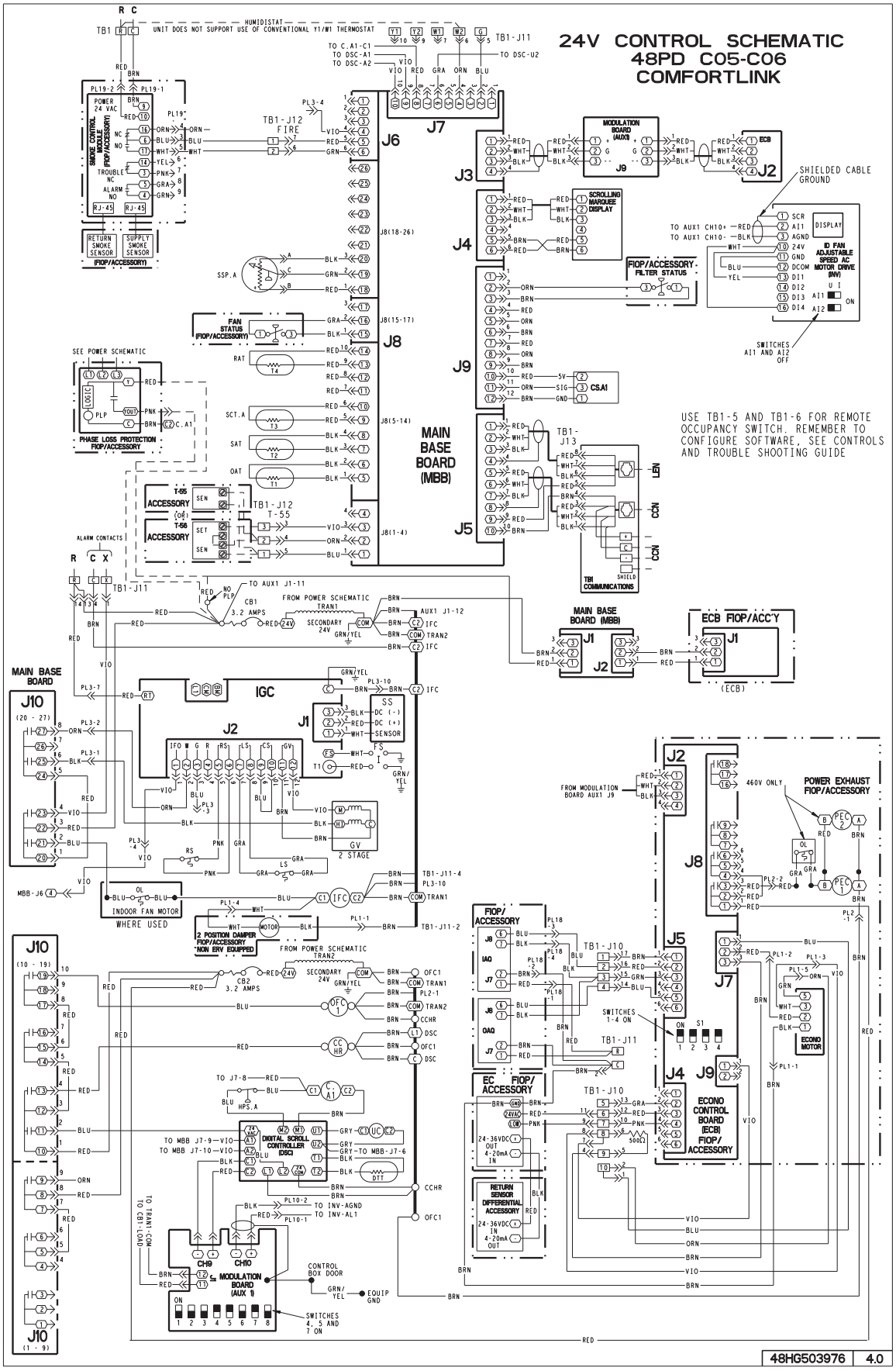
48PD05-06 Without Powered Convenience Outlet

48PD UNIT SIZE	NOMINAL POWER SUPPLY V-PH-HZ	VOLTAGE RANGE		COMPRESSOR		OFM		COMBUST. FAN MOTOR FLA	CONV OUTLET	POWER EXH FLA (ea)	IFM TYPE	IFM FLA	POWER SUPPLY		DISCONNECT SIZE	
		Min	Max	RLA	LRA	Qty	FLA (ea)						MCA	MOCP	FLA	LRA
05	208/230-3-60	187	253	16.1	110	1	1.0	0.52	None	—	STD	5.2	26.3/26.3	40/40	26/26	142/142
											ALT	5.2	26.3/26.3	40/40	26/26	142/142
										1.4	STD	5.2	27.7/27.7	40/40	27/27	144/144
											ALT	5.2	27.7/27.7	40/40	27/27	144/144
	460-3-60	414	506	7.8	52	1	0.5	0.30	None	—	STD	2.6	12.9	20	13	68
											ALT	2.6	12.9	20	13	68
										0.6	STD	2.6	13.5	20	13	69
											ALT	2.6	13.5	20	13	69
06	208/230-3-60	187	253	17.9	110	1	1.5	0.52	None	—	STD	5.2	29.1/29.1	45/45	28/28	143/143
											ALT	5.2	29.1/29.1	45/45	28/28	143/143
										1.4	STD	5.2	30.5/30.5	45/45	30/30	145/145
											ALT	5.2	30.5/30.5	45/45	30/30	145/145
	460-3-60	414	506	7.8	52	1	0.8	0.30	None	—	STD	2.6	13.2	20	13	69
											ALT	2.6	13.2	20	13	69
										0.6	STD	2.6	13.8	20	14	70
											ALT	2.6	13.8	20	14	70

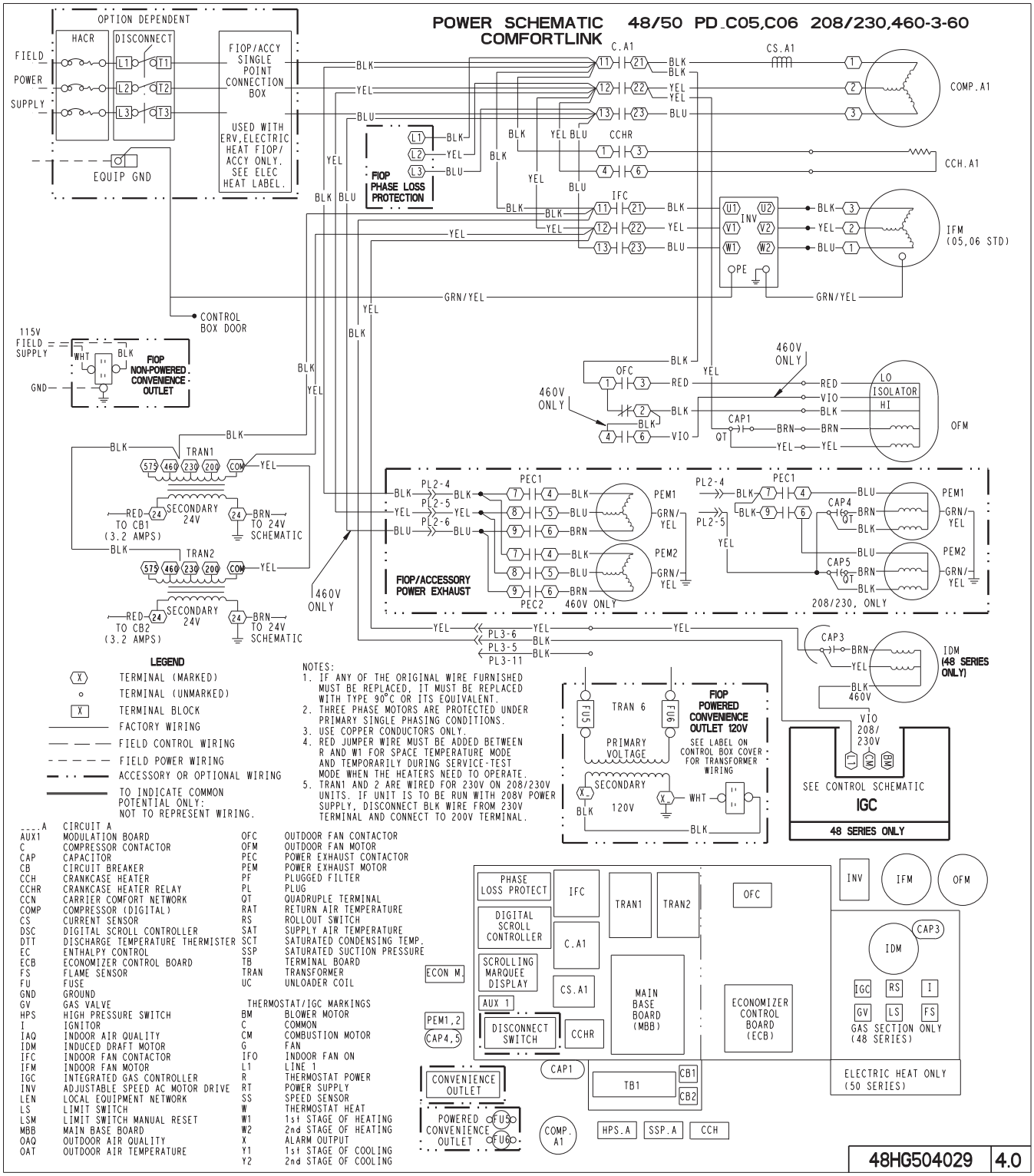
48PD05-06 With Powered Convenience Outlet

48PD UNIT SIZE	NOMINAL POWER SUPPLY V-PH-HZ	VOLTAGE RANGE		COMPRESSOR		OFM		COMBUST. FAN MOTOR FLA	CONV OUTLET	POWER EXH FLA (ea)	IFM TYPE	IFM FLA	POWER SUPPLY		DISCONNECT SIZE	
		Min	Max	RLA	LRA	Qty	FLA (ea)						MCA	MOCP	FLA	LRA
05	208/230-3-60	187	253	16.1	110	1	1.0	0.52	Yes	—	STD	5.2	31.1/31.1	45/45	31/31	147/147
											ALT	5.2	31.1/31.1	45/45	31/31	147/147
										1.4	STD	5.2	32.5/32.5	45/45	33/33	149/149
											ALT	5.2	32.5/32.5	45/45	33/33	149/149
	460-3-60	414	506	7.8	52	1	0.5	0.30	Yes	—	STD	2.6	15.1	20	15	70
											ALT	2.6	15.1	20	15	70
										0.6	STD	2.6	15.7	20	16	71
											ALT	2.6	15.7	20	16	71
06	208/230-3-60	187	253	17.9	110	1	1.5	0.52	Yes	—	STD	5.2	33.9/33.9	50/50	34/34	148/148
											ALT	5.2	33.9/33.9	50/50	34/34	148/148
										1.4	STD	5.2	35.3/35.3	50/50	35/35	150/150
											ALT	5.2	35.3/35.3	50/50	35/35	150/150
	460-3-60	414	506	7.8	52	1	0.8	0.30	Yes	—	STD	2.6	15.4	20	15	71
											ALT	2.6	15.4	20	15	71
										0.6	STD	2.6	16.0	20	16	72
											ALT	2.6	16.0	20	16	72

WIRING DIAGRAMS


24V CONTROL SCHEMATIC
48PD C05-C06
COMFORTLINK
MAIN BASE BOARD (MBB)
IGC
MODULATION BOARD (AUX)
SCROLLING MARQUEE DISPLAY
ECB
ID FAN ADJUSTABLE SPEED AC MOTOR DRIVE (INV)
DIGITAL SCROLL CONTROLLER (DSC)
ECONO CONTROL BOARD (ECB) FIOP/ ACCESSORY
POWER EXHAUST FIOP/ACCESSORY
2 POSITION DAMPER FIOP/ACCESSORY NON ERV EQUIPPED
INDOOR FAN MOTOR
PHASE LOSS PROTECTION FIOP/ACCESSORY
SMOKE CONTROL MODULE (FIOP/ACCESSORY)
RETURN SMOKE SENSOR (FIOP/ACCESSORY)
SUPPLY SMOKE SENSOR (FIOP/ACCESSORY)
FAN STATUS (FIOP/ACCESSORY)
FIOP/ACCESSORY FILTER STATUS
ECB FIOP/ACC'Y
USE TB1-5 AND TB1-6 FOR REMOTE OCCUPANCY SWITCH. REMEMBER TO CONFIGURE SOFTWARE, SEE CONTROLS AND TROUBLE SHOOTING GUIDE
48HG503976 4.0

C10046



----.A	CIRCUIT A		
AUX1	MODULATION BOARD	OFC	OUTDOOR FAN CONTACTOR
C	COMPRESSOR CONTACTOR	OFM	OUTDOOR FAN MOTOR
CAP	CAPACITOR	PEC	POWER EXHAUST CONTACTOR
CB	CIRCUIT BREAKER	PEM	POWER EXHAUST MOTOR
CCH	CRANKCASE HEATER	PF	PLUGGED FILTER
CCHR	CRANKCASE HEATER RELAY	PL	PLUG
CCN	CARRIER COMFORT NETWORK	QT	QUADRUPLE TERMINAL
COMP	COMPRESSOR (DIGITAL)	RAT	RETURN AIR TEMPERATURE
CS	CURRENT SENSOR	RS	ROLLOUT SWITCH
DSC	DIGITAL SCROLL CONTROLLER	SAT	SUPPLY AIR TEMPERATURE
DTT	DISCHARGE TEMPERATURE THERMISTER	SCT	SATURATED CONDENSING TEMP.
EC	ENTHALPY CONTROL	SSP	SATURATED SUCTION PRESSURE
ECB	ECONOMIZER CONTROL BOARD	TB	TERMINAL BOARD
FS	FLAME SENSOR	TRAN	TRANSFORMER
FU	FUSE	UC	UNLOADER COIL
GND	GROUND		
GV	GAS VALVE		THERMOSTAT/IGC MARKINGS
HPS	HIGH PRESSURE SWITCH	BM	BLOWER MOTOR
I	IGNITOR	C	COMMON
IAQ	INDOOR AIR QUALITY	CM	COMBUSTION MOTOR
IDM	INDUCED DRAFT MOTOR	G	FAN
IFC	INDOOR FAN CONTACTOR	IFO	INDOOR FAN ON
IFM	INDOOR FAN MOTOR	L1	LINE 1
IGC	INTEGRATED GAS CONTROLLER	R	THERMOSTAT POWER
INV	ADJUSTABLE SPEED AC MOTOR DRIVE	RT	POWER SUPPLY
LEN	LOCAL EQUIPMENT NETWORK	SS	SPEED SENSOR
LS	LIMIT SWITCH	W	THERMOSTAT HEAT
LSM	LIMIT SWITCH MANUAL RESET	W1	1st STAGE OF HEATING
MBB	MAIN BASE BOARD	W2	2nd STAGE OF HEATING
OAQ	OUTDOOR AIR QUALITY	X	ALARM OUTPUT
OAT	OUTDOOR AIR TEMPERATURE	Y1	1st STAGE OF COOLING
		Y2	2nd STAGE OF COOLING

C10053

SEQUENCE OF OPERATION

General

The 48PD rooftop units use Puron® (R-410A) refrigerant and ComfortLink™ DDC controls. The PD units are intended to be used in a either a displacement ventilation or a single-zone variable air volume application. The PD unit includes a factory installed variable capacity compressor and variable frequency drive indoor fan motor. The unit is controlled by space temperature via space temperature sensor such as a T-55, T-56 or T58. The unit will not operate with a conventional R, Y1, Y2, W1, W2, G, C thermostat. When a space temperature sensor is connected to the low voltage terminal board as shown in the Installation Instructions Manual, the unit will try to maintain the Space Temperature (SPACE_T) at one of four set points:

- Occupied Cool Set Point (OCSP)
- Unoccupied Cool Set Point (UCSP)
- Occupied Heat Set Point (OHSP)
- Unoccupied Heat Set Point (UHSP)

The building's occupancy is affected by a number of different factors (see Controls and Troubleshooting Guide for details).When the building is in occupied mode, the occupied set points are active. When the building is in unoccupied mode, the unoccupied set points are active. The unit controls will switch automatically between cooling and heating to maintain temperature. However, to minimize unnecessary cool to heat and heat to cool changes, there is a 10 minute delay after the last stage turns off before the control will switch modes.

NOTE: Use of a supply air pressure input to control the Centurion PD unit to a constant supply air pressure value is not supported nor recommended. The space temperature sensor is a thermistor input to the main base board. Electrical input to the main control board (MBB) is a resistance value corresponding to a temperature in the space. This input will only respond to resistance of the device connected to it. A free pressure transducer input is available on the MBB and there are also pressure transducer inputs on the AUX1 board. However, use of these inputs from a supply air pressure sensor will not be interpreted by the ComfortLink in the desired manner and consequently, proper unit control will not be achieved.

Cooling Mode Using Space Temperature Sensors: T55, T56, or T58 (No Economizer)

In the cooling mode, the unit will maintain the Occupied Cool Set Point (OCSP) (or the Unoccupied Cool Set Point (UCSP)) by modulating the indoor fan speed to provide variable airflow to the conditioned space. The compressor will modulate to maintain the supply air temperature at the Cool Supply Air Set Point. Additional factors such as humidity control (Cooling Supply Air Reset), economizer usage, Demand Control Ventilation and ventilate mode can also affect this sequence.

Cooling Supply Air Setpoint

The Cool Supply Air Set Point can be configured between 45°F and 75°F. The compressor will modulate to maintain a Supply Air Temperature at the Cool Supply Air Set Point (SASP).

Cooling Demand Window

The PD unit indoor fan is controlled via Cooling Demand Window fan speed logic sequence. (See Fig. 1.) When the temperature in the conditioned space is higher than the Occupied Cool Set Point (OCSP) plus the Fan Speed Control Demand (SPEEDDMD) configuration variable (or Unoccupied Cool Set Point (UCSP) plus the Fan Speed Control Demand (SPEEDDMD) configuration variable) the indoor fan will run at 100%. When the temperature in the conditioned space is between the Occupied Cool Set Point (OCSP) and Occupied Cool Set Point (OCSP) plus the Fan Speed Control Demand (SPEEDDMD) configuration variable the indoor fan modulates to satisfy the Occupied Cool Set Point (OCSP) or Unoccupied Cool Set Point (UCSP). When the temperature in the conditioned space falls to 0.5°F below the Occupied Cool Set Point (OCSP) or Unoccupied Cool Set Point (UCSP) for 5 minutes the controls will run unit in ventilation mode. See ventilation mode sequence of operation for details on this mode.

Cooling Supply Air Setpoint Reset

The PD unit can be configured to allow for reset of the Cool Supply Air Set Point (SASP). This is needed for applications where a high Cool Supply Air Set Point (SASP) is required or where dramatic load changes occur over short time periods. In these situations a high supply air temperature may not provide enough cooling to reduce the Space Temperature (SPACE_T) to the Occupied Cool Set Point (OCSP) or the Unoccupied Cool Set Point (UCSP) over a reasonable time period.

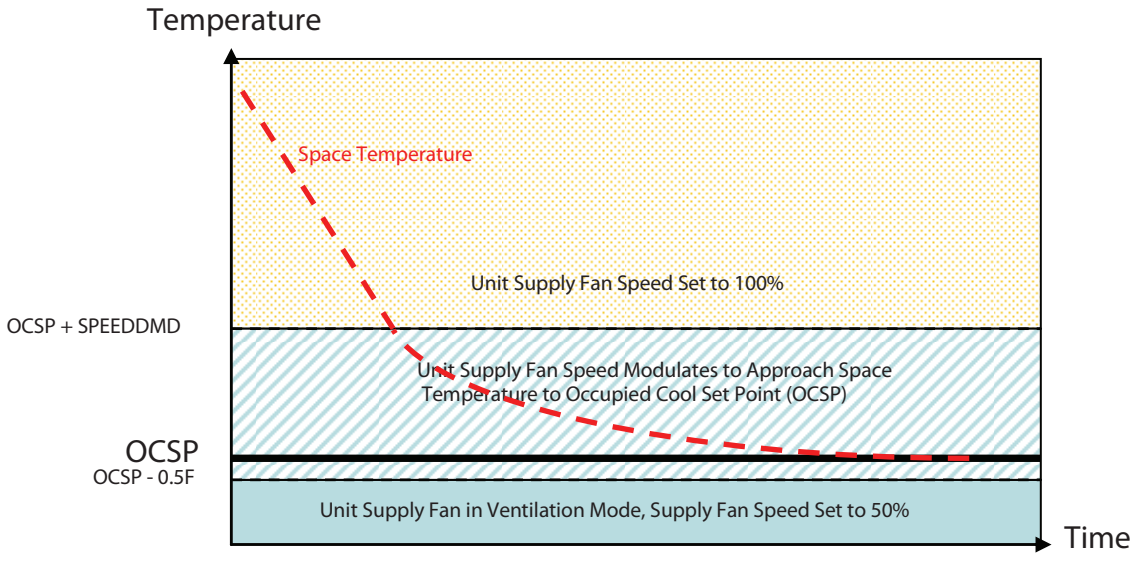

Temperature
Space Temperature
Unit Supply Fan Speed Set to 100%
OCSP + SPEEDDMD
Unit Supply Fan Speed Modulates to Approach Space Temperature to Occupied Cool Set Point (OCSP)
OCSP
OCSP - 0.5F
Unit Supply Fan in Ventilation Mode, Supply Fan Speed Set to 50%
Time

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Fig. 1 - Cooling Demand Window Fan Speed Logic

Reset of the Cooling Supply Air Set Point is set by the configuration variables SASP Maximum Reset Down (SASPMAXD) and SASP Maximum Reset Up (SASPMAXU).

The SASP Maximum Reset Down (SASPMAXD) configuration variable can be set from -20° to 0°F and will allow the Supply Air Temperature to be Reset to as much as 20 F below the Cool Supply Air Set Point (SASP).

The SASP Maximum Reset Up (SASPMAXU) configuration variable can be set from 0° to 20°F and will allow the Supply Air Temperature to be Reset to as much as 20 F above the Cool Supply Air Set Point (SASP).

These two configuration variables can be set independently and do not need to be equal values above and below the Supply Air Set Point. For example, the SASP Maximum Reset Down (SASPMAXD) configuration variable can be set to -10 and the SASP Maximum Reset Up (SASPMAXU) configuration variable can be set to 0 giving the range of Cool Supply Air Set Point (SASP) reset of +0 and -10°F. (See Fig. 2.)

In normal operation when the Space Temperature (SPACE_T) is within the speed demand window the unit control will modulate the indoor fan speed and supply air temperature along a defined curve to bring the Space Temperature to Occupied or Unoccupied Cool Set Point (OCSP or UCSP). Since this curve is independent of the conditioned space load the control scheme will adapt to any load present in the conditioned space by adjusting the fan speed and supply air temperature and move the space temperature along the defined time temperature curve to Occupied or Unoccupied Cool Set Point (OCSP OR UCSP).

Cooling Mode with Economizer Using Space Temperature Sensor T55, T56 or T58

If an economizer is installed, the damper is controlled by the Economizer Commanded Position on the Economizer Control Board (ECB). Feedback from the economizer actuator is output to the ECB and is displayed as Econo-Actual Position in the *Comfort*Link™ control menu. The Economizer is used for ventilation, cooling and to control the power exhaust. If the Indoor fan is not on, the economizer will not operate.

The economizer actuator used with the PD units is a Multi-Function Technology (MFT) actuator. This allows the *Comfort*Link system to communicate with the actuator digitally using Belimo MP protocol. During this digital control, the Economizer Control Board analog 4 to 20 mA output will represent the actuator's actual position when or commanded position as selected by the configurable setpoint. This feedback from the actuator to the *Comfort*Link controller allows *Comfort*Link to change the damper position as the indoor fan changes speed.

When the space temperature is above the Occupied Cool Set Point (OCSP) and the economizer is installed, the unit controls will always try to meet space cooling demand using the economizer before turning on a compressor, per the ASHRAE 90.1 requirement for energy efficient integrated economizer operation. The economizer will provide free cooling as long as the outside air temperature or enthalpy (depending which sensors are used) is within the constraints of the adjustable high & low limit setpoints. When the compressors are activated, the economizer dampers will be controlled to the minimum damper position based on the control strategy used (temperature, enthalpy, CO_2, etc) and the indoor fan speed operation.

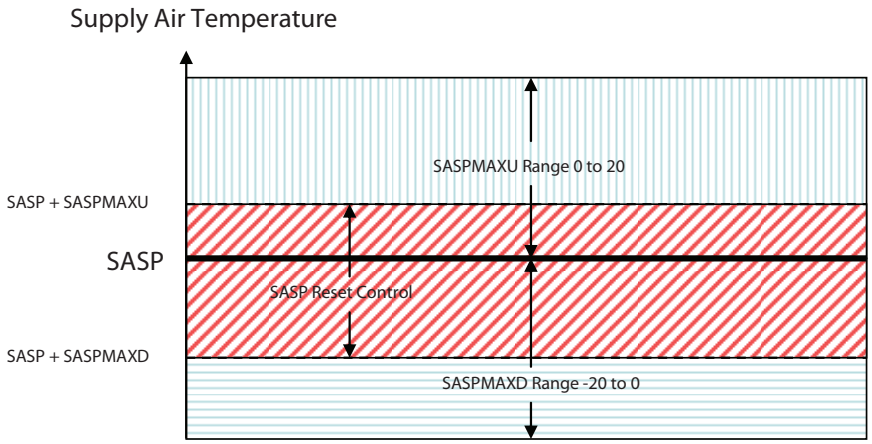

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Fig. 2 - Cooling Supply Air Set Point Reset

Cooling Mode Using Space Temperature Sensor T55, T56 or T58 and Humidistat

Enhanced dehumidification can be provided when a humidistat (HL38MG029, TSTATCCPLH01-B or 33CS2PPRH-01) is connected. When the humidistat contacts close and provide a 24VAC signal, the unit will reset the supply air temperature by one degree F lower than the Supply Air Set Point (SASP) or the current control point if the Supply Air Set Point has already been modified. After 5 minutes if the humidistat contacts are still closed and 24 VAC is being supplied to the W2 terminal the PD unit will reset the supply air temperature lower by one more degree F. This reset cycle will continue to lower the supply air temperature every 5 minutes until the supply air temperature control point is equal to the Supply Air Set Point + SASP Maximum Reset Down ((SASP+SASPMAXD). The unit will continue to operate at this reduced supply air temperature control point until the humidistat contacts open and 24VAC is no longer supplied to the W2 terminal.

When the dehumidification signal is no longer supplied, the supply air control point will be reset higher by one degree F, in 3 minute intervals until the supply air temperature control point is equal to the Supply Air Set Point (SASP) or the supply air control point if reset was being applied due to cooling requirements that reset the Supply Air Set Point (SASP).

Whenever the Relative Humidity Reset is applied, the space temperature is controlled by modulating the fan speed even if the fan was locked at 100% due to SASP reset.

Cooling Mode Using Space Temperature Sensor T55, T56 or T58 and Humidity Sensor

Enhanced dehumidification can be provided when a humidly sensor (HL39ZZ007 or 33ZCSENRH-01) is connected. When the relative humidity in the space is above the relative humidity set point the PD unit controls will reset the supply air per the same logic as described for a humidistat above.

Ventilation Mode

The economizer will open to allow ventilation when the indoor fan is turned on and the unit is in the occupied state. The economizer damper position at any given time for ventilation is displayed as the Min Position in Effect data point in the *Comfort*Link™ menus. This minimum position can be effected by the indoor fan speed and indoor air quality. To maintain a constant airflow through the economizer, as the indoor fan speed decreases or increases, the damper minimum position will increase or decrease, respectively. This relationship curve is shown in Fig. 3. This damper position curve can be field adjusted per application, if required.

These units can also be equipped with optional CO_2 sensors for additional indoor air quality control. When unit is equipped with a CO_2 sensor the Economizer minimum position vs. fan speed curve will be recalculated based on the CO_2 level of the return and/or outside air as shown in Fig. 3. When the Commanded Fan Speed (F.SPD) is between Supply Fan Maximum Speed (FS.MX) and the Supply Fan Minimum Speed (FS.MN) the damper will operate in the shaded area of Fig. 3 based on the IAQ Level (IAQ). See the Indoor Air Quality (IAQ) section for more details on Demand Control Ventilation (DCV).

Heating Mode Using Space Temperature Sensor T55, T56 or T58

In heating mode the PD unit will maintain the Occupied Heat Set Point (OHSP) or the Unoccupied Heat Set Point (UHSP) by turning on or off the Stage 1 and Stage 2 Heat at 100% indoor fan speed. For units with an economizer, the outdoor air damper stays at the Economizer Minimum Position while the evaporator fan is operating and shuts when the indoor fan is off.

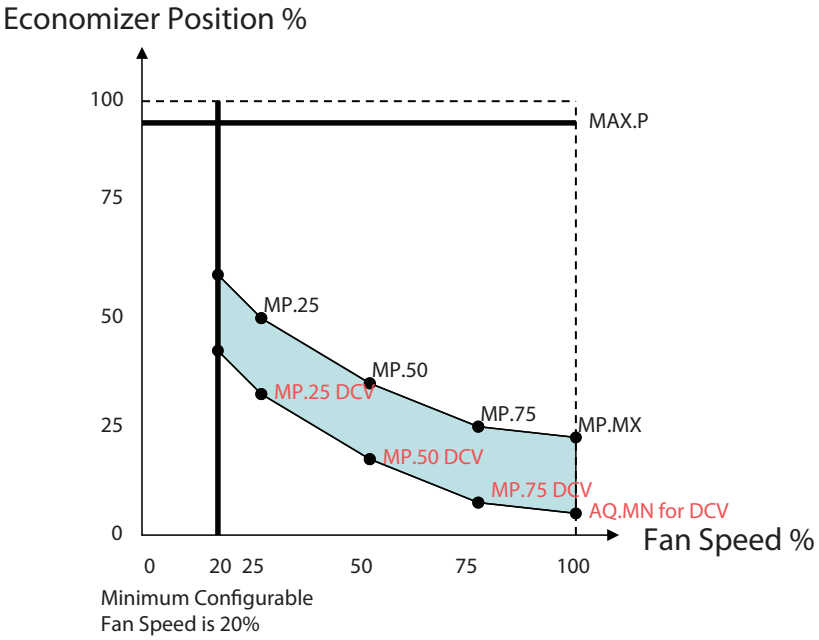

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Fig. 3 - Minimum Damper Position Curve

APPLICATION DATA

Ductwork

Ductwork should be attached to the curb on all units. Ductwork should NOT be attached to the unit. Interior installation may be placed before unit is set in place on roof.

Thru-the-Bottom Service Connections

Roof curb connections allow field power wires and control wires to enter through the roof curb opening and bottom of unit through the removable plate in the bottom of the compressor compartment.

Space Temperature Sensor

A space temperature sensor is required for all units.

Airflow

Units are draw-thru for cooling and blow-thru for heating.

Maximum Airflow

The maximum unit airflow is 500 cfm/nominal ton.

Minimum Airflow

The minimum design airflow for cooling is 300 cfm/nominal ton. See the Operation Air Quantity Limits table for minimum airflow cfm for heating. The PD unit will modulate the fan speed up/down from the design value according the logic in the sequence of operation.

IMPORTANT: The minimum heating cfm must be maintained to ensure proper operation in the Heating mode. The minimum heating cfm value takes precedence over the minimum cooling cfm value.

Minimum Ambient Cooling Operation Temperature

All Centurion PD units utilize *Comfort*Link controls which are designed to allow operation down to ambient outdoor temperatures of 0°F.

Maximum Operating Outdoor-Air Temperature

For cooling, the maximum operating ambient temperature is 125°F.

High Altitude

A change to the gas orifice may be required at high altitudes. Refer to Altitude Compensation charts.

Minimum Heating Entering Air Temperature

For operation with heat exchanger entering air temperatures below 50°F continuous / 45°F intermittent, a stainless steel heat exchanger is strongly recommended. Additionally, a field-supplied outdoor air thermostat is recommended to initiate both stages of heat when the entering air is below the following limits (See Fig. 4.):

. . . . . Aluminized Steel: 50°F continuous / 45°F intermittent

. . . . . Stainless Steel: 40°F continuous / 35°F intermittent

This will minimize cold air dumping into the space due to initiating both stages of heat for full fire operation. Wire the outdoor air thermostat (part no. HH22AG106) in series with the second stage gas valve as shown below. Set the outdoor air thermostat at 35°F for stainless steel heat exchangers or 45°F for aluminum heat exchangers.

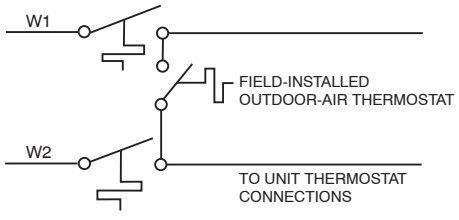

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Fig. 4 - Field-Supplied Outdoor Air Thermostat

Sizing a PD Rooftop Unit

The Centurion PD rooftop unit utilizes variable compressor loading and variable fan speed to modulate the rooftop unit's capacity from full design capacity down to part-load requirements. Bigger is not necessarily better. While an air conditioner needs to have enough capacity to meet the design loads, excess capacity results in poor part-load performance and humidity control. Using higher design temperatures than ASHRAE recommends for your location and adding "safety factors" to the calculated load, are all signs of over-sizing air conditioners.

Over-sizing the air conditioner leads to poor humidity control, reduced efficiency, higher utility bills, larger indoor temperature swings, excessive noise, and increased wear and tear on the air conditioner. Rather than over-sizing an air conditioner, designers should "right-size" or even slightly undersize air conditioners.

Correctly sizing an air conditioner results in better control of space humidity, promotes efficiency, reduces utility bills, extends equipment life, and maintains even, comfortable temperatures. Please contact your local Carrier representative for further assistance.

Outdoor Air Application Strategies

Any of the following devices can be used for outdoor/ventilation air: manual damper, two position damper, economizer or an energy recovery device.

Manual and Two Position Dampers

Manual and two position dampers increase the load and operating expense on the RTU because they are fixed and not variable. Additionally, these devices will contribute to unsatisfactory space conditioning because they will not modulate with the changing outdoor air conditions.

Economizers

As promulgated by ASHRAE, economizers reduce operating expenses and compressor run time by providing a source of free cooling and a means of ventilation to match changing application needs. When properly designed (per ASHRAE standards), the economizer will control the amount of outdoor air allowed into the building and is integrated with the operation of the compressors.

Carrier economizers are properly designed and allow free cooling to occur when the outdoor air is suitable depending upon the control strategy chosen. As a result, they should be considered for most applications in lieu of manual or two position dampers. It has also been proven (by multiple sources) that using economizers with a Demand Control Ventilation (CO_2) strategy will result in considerable energy savings over a manual damper, two-position damper or no damper applications.

Energy Recovery Device

Energy recovery devices typically result in substantial energy savings over other outdoor air devices. They typically add sensible and latent capacity, and additional stages of cooling and heating operation to the unit. Due to the variable capacity compressor and fan system, care must be taken when incorporating an energy recovery unit with a Centurion PD unit. The energy recovery fan operation must be controlled in conjunction with the varying speed of the RTU fan.

Please contact your local Carrier representative for further assistance.

Low Ambient Applications

In most low ambient cooling situations, the optional Carrier economizer can adequately cool the space by bringing in low temperature outside air. In fact, when an economizer is used, accessory low-ambient kits are typically not necessary. Additionally, unless the outdoor air is excessively contaminated, economizer based "free cooling" is the preferred less costly and energy conscious method of low ambient cooling.

In low ambient applications where outside air might not be desired (such as contaminated air applications), a head pressure control device can control the condenser head pressure to allow compressor operation down to ambient temperatures of 0F. Please contact your local Carrier representative for further assistance in choosing an appropriate low ambient device.

Condenser Coil Protection (Enviro-Shield™)

Pre-coated aluminum-fin coils have a durable epoxyphenolic coating applied to the fin prior to the fin stamping process to provide protection in mildly corrosive coastal environments. Pre-coated coils have an inert barrier between the aluminum fin and copper tube. This barrier electrically disconnects the dissimilar metals to minimize the potential for galvanic corrosion. This economical option provides substantial corrosion protection for mild coastal environments beyond the standard uncoated coil construction.

Copper-fin coils provide increased corrosion resistance in moderate coastal environments where industrial air pollution is not present. All copper coils eliminate bi-metallic construction to eliminate the potential for galvanic corrosion. Use of copper fin coils in industrial environments is not recommended due to potential attack from sulfur, sulfur oxide, nitrogen oxides, carbon and several other industrial airborne contaminants. In moderate seacoast environments, copper-fin coils have extended life compared to standard or pre-coated aluminum-fin coils.

E-Coated aluminum-fin coils undergo a precisely controlled scientific process that bonds an impermeable epoxy coating to the specially prepared fin coil surface. E-Coating produces a smooth, consistent coating that is less brittle, more resilient and more durable than previous post coating processes. E-Coated aluminum fin coils offer economical protection and improved coil life in industrial and combined coastal and industrial environments.

E-Coated copper-fin coils provide maximum protection in virtually all environments, this option combines the continuous, impenetrable barrier of the E-Coating process with the natural resistance of an all-copper construction. E-Coated copper-fin coil assemblies ensure long life in severe coastal conditions.

Indoor Air Quality

An indoor air quality sensor, which senses CO_2, is a factory installed option. The sensor in conjunction with the economizer is used to maintain indoor air quality. By selecting this option, the minimum economizer position can be reduced because the control will adjust economizer position to maintain indoor air quality to the desired set point. A wall-mounted indoor air quality sensor is a field-installed accessory.

Enthalpy Sensor

Enthalpy switches are available as field-installed accessories. If only one switch is used, it is used to measure return air enthalpy. If two switches are used they should be wired in a differential configuration to measure the difference in the return and outdoor enthalpies. The enthalpy switches signify when the outdoor air is suitable for free cooling.

Plugged Filter Indicator

A plugged filter indicator (filter status switch) is available as a factory-installed option and a field-installed accessory. By measuring the pressure differential across the evaporator section, it signals when the evaporator filters should be cleaned.

Fan Status

A fan status switch is available as a factory-installed option and a field-installed accessory. By sensing the pressure differential generated by the indoor fan, it signals the *Comfort*Link system when the indoor fan blower is operating and therefore it is very useful for detecting broken belts, etc.

GUIDE SPECIFICATIONS

Packaged Rooftop Electric Cooling Unit with Gas Heat, Variable Capacity, Variable Air Volume Cooling Constant Air Volume Heating with Puron® R-410A Refrigerant and *Comfort*Link™ Controls

Cooling Size Range: 4 to 5 Tons, Nominal Cooling 48,000 to 60,000 Btuh

Heating Size Range: 35,700 to 121,5000 MBtuh (Gas heat output)

Carrier Model Numbers: 48PD

Part I. General

1.01 SYSTEM DESCRIPTION

Outdoor only, rooftop mounted, electrically controlled, heating and cooling unit utilizing fully hermetic digital scroll compressors with on demand crankcase heaters for cooling duty and induced draft gas combustion for heating duty. Supply air shall be discharged downward or horizontally. Supply air fan system shall be a variable air flow design to deliver a variable quantity and temperature of air to meet the space cooling and heating demand. Controls shall adjust supply air quantity and temperature to adapt to conditioned space load demand. Units shall be of ultra high cooling efficiency and utilize environmentally friendly Puron (R-410A) refrigerant.

1.02 QUALITY ASSURANCE

A. Unit shall well exceed ASHRAE 90.1-2004 and ENERGY STAR efficiency standards. SEER shall be as high as 15.

B. Unit shall be rated in accordance with ARI Standards 210.

C. Units shall be designed in accordance with UL Standard 1995. Unit shall be UL and UL Canada, tested as a total package.

D. Unit shall be rated in accordance with ARI sound standards 270.

E. Unit shall be designed to conform to ASHRAE 15.

F. Roof curb shall be designed to conform to NRCA Standards.

G. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

H. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

I. Unit shall be manufactured in a facility registered to ISO 9001:2000.

J. Each unit shall be subjected to a completely automated run testing on the assembly line.

1.03 DELIVERY, STORAGE, AND HANDLING

Unit shall be stored and handled per manufacturer's recommendations.

Part II. Products

2.01 EQUIPMENT (STANDARD)

A. General

The unit shall be a fully factory assembled, pre-tested, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, Puron refrigerant charge (R- 410A), and all special features required prior to field start-up.

B. Unit Cabinet

1. Constructed of galvanized steel, bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces. Internal surfaces shall be of a primer coated finish.
2. All air stream interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density foil faced cleanable insulation. Insulation shall be bonded with a thermosetting resin (8 to 12% by weight nominal, phenol formaldehyde typical), and coated with an acrylic or other material that meets the NFPA 90 flame retardance requirements and has an "R" value of 3.70. Insulation shall also be encapsulated with panel design or tape edges ensuring secure fit.
3. Cabinet panels shall be hinged with integrated non-corrosive hinges. Large area hinged access panels for the filter, compressors, evaporator fan, and control box and heat section areas. Each panel shall use multiple quarter-turn latches and handles. Each major external hinged access panel shall be double-wall construction and permanently attached to the rooftop unit. Panels shall also include tiebacks.
4. Return air filters shall be accessible through a dedicated hinged access panel and be on a slide-out track using standard size filters. Filter shall be standard off the shelve sizes and be the size per cabinet. Capability for 2 or 4 inch filters shall be on all sizes.
5. Holes shall be provided in the base rails (minimum 16 gauge) for rigging shackles and level travel and movement during overhead rigging operations.
6. Fork lift slots shall be available from three sides of the unit (end and 2 sides).
7. Unit shall have a factory-installed internally sloped condensate drain pan, providing a minimum 3/4-in. 14 NPT connection to prevent standing water from accumulating. Pan shall be fabricated of high impact polycarbonate material and shall slide out for cleaning and or maintenance. An alternate vertical drain (3/4-in. NPT) connection shall also be available. All drain pans conform to ASHRAE 62 self draining provisions.
8. Unit shall have standard thru-the-bottom power and control wiring connection capability.

C. Fans

1. Indoor Blower (evaporator fan):
   a. Centrifugal supply air blower shall have rubber-isolated, cartridge type ball bearings and adjustable belt drive.
   b. Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades.
   c. The indoor fan system (blower wheels, motors, belts, and both bearings) shall slide out for easy access.
   d. Evaporator-fan motors shall be continuous operation, open drip-proof. Bearings shall be sealed, permanently lubricated ball bearing type for longer life and lower maintenance.
   e. Fan belt shall be located on opposite side of evaporator coil to prevent damage from broken fan belts.
   f. Evaporator fan motor Adjustable Speed AC drive – shall follow the provisions of UL 508C, shall have casing material rated for plenum use, shall control the motor from 20% to 100% of the 60Hz speed with input signal derived from the space temperature. AC drive shall have a display for setting drive parameters that can be mounted remote from the AC drive.
2. Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades riveted to corrosion-resistant steel supports. They shall be dynamically balanced and discharge air upwards. Condenser-fan motors shall be totally enclosed, thermally protected, and be of a shaft down design to protect from direct contact from harsh environments.

3. Induced-draft blower shall be of the direct driven, single inlet, forward-curved, centrifugal type. It shall be made from aluminized steel with a corrosion-resistant finish and shall be dynamically balanced.

D. Compressor(s)

1. Fully hermetic, digital scroll type with capacity modulation accomplished by separation of the scroll volutes by pulse width modulation control to provide any capacity between 15 and 100%. Compressor shall have internal high-pressure and temperature protection. Crankcase heaters shall energize on demand.
2. Factory mounted on rubber grommets and internally spring mounted for vibration isolation.
3. Compressor shall be mounted on dedicated mounting plate to ensure secure design and reduced sound levels.
4. Compressor shall be equipped with sound shield to reduce differences in compressor sound between the loaded and unloaded states.

E. Coils

1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Condenser and evaporator coils shall be single slab, single pass design to facilitate easy coil cleaning. Composite coils or coils that require unit top panels removed shall be unacceptable.
3. Coils shall be leak tested at 170 psig and pressure tested at 1875 psig.
4. Optional Coils:
   a. Optional pre-coated aluminum-fin coils shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.
   b. Optional copper-fin coils shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets. Galvanized steel tube sheets shall not be acceptable. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan. All copper construction shall provide protection in moderate coastal environments.
   c. Optional E-Coated aluminum-fin coils shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation. Color shall be high gloss black with gloss -- 60 deg of 65 to 90% per ASTM D523-89. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and crosshatch adhesion of 4B-5B per ASTM D3359-93. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870- 92). Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90. Coil construction shall be aluminum fins mechanically bonded to copper tubes. E-Coated aluminum-fin coils shall provide protection in industrial and industrial and coastal combined environments.
   d. Optional E-Coated copper-fin coils shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation. Color shall be high gloss black with gloss - 60 deg of 65 to 90% per ASTM D523- 89. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and crosshatch adhesion of 4B-5B per ASTM D3359-93. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870- 92). Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90. Coil construction shall be copper fins mechanically bonded to copper tubes with copper tube sheets. Galvanized steel tube sheets shall not be acceptable. A polymer strip shall prevent coil assembly from contacting sheet metal coil pan to maintain coating integrity and minimize corrosion potential between coil and pan. E-Coated copper-fin coils shall provide protection in severe coastal environments.

F. Heating Section

1. Induced-draft combustion type with energy saving direct-spark ignition system and redundant main gas valve with 2-stage capability on all 3-phase units.
2. Heat Exchanger:
   a. The standard aluminized heat exchanger shall be of the tubular-section type constructed of a minimum of 20-gauge steel coated with a nominal 1.2 mil aluminum-silicone alloy for corrosion resistance.
   b. The optional stainless steel heat exchanger shall be of the tubular-section type, constructed of a minimum of 20-gauge type 409 stainless steel, including stainless steel tubes, vestibule plate, and collector box.
3. Burners shall be of the in-shot type constructed of aluminumcoated steel.
4. All gas piping shall enter the unit at a single location. Gas entry shall be capable through side or bottom for unit.
5. All factory-installed orifices are for operation up to 2,000 feet of altitude. For altitudes between 2,000 ft and 7,000 ft, a factory certified kit shall be furnished for field installation.
6. The integrated gas controller (IGC) board shall include gas heat operation fault notification using an LED (light-emitting diode).
7. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high-temperature limit switch. Fault indication shall be made using an LED.
8. The IGC board shall contain algorithms that modify evaporatorfan operation to prevent future cycling on high-temperature limit switch.
9. The LED shall be visible without removal of control box access panel.
10. Gas burner tray, when disconnected, shall easily slide out for maintenance.

G. Refrigerant Components

Each refrigerant circuit shall include:

1. One balanced port thermostatic expansion valve (TXV) with removable power element.
2. Solid core refrigerant filter driers with pressure ports.
3. Refrigerant pressure gauge ports and connections on suction, discharge, and liquid lines.

H. Filter Section

1. Standard filter section shall consist of factory installed 2-in. thick disposable fiberglass filters and shall be on a dedicated slide out track to easily facilitate access and replacement.
2. Filter section shall use standard size filters and be of common sizes within cabinet sizes.
3. Optional MERV-8 pleated filters of commercially available sizes shall be available.
4. Standard 2-in. filter rack shall be field convertible to 4-in. by removing a spacer.

I. Controls and Safeties

1. Unit shall include DDC controls (*Comfort*Link™) as a standard feature.
   a. Scrolling Marquee display.
   b. CCN (Carrier Comfort Network) capable protocol.
   c. Unit control with standard suction pressure transducer and condensing temperature thermistor.
   d. Shall provide a 5°F temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard.
   e. Shall provide and display a current alarm list and an alarm history list.
   f. Service run test capability.
   g. Shall accept input from a CO_2 sensor (both indoor and outdoor).
   h. Configurable alarm light shall be provided which activates when certain types of alarms occur.
   i. Compressor minimum run time (3 minutes) and minimum off time (5 minutes) are provided.
   j. Service diagnostic mode.
   k. Economizer control (optional).
   l. Adaptive conditioned space control logic that matches the compressor capacity and evaporator air flow to the space cooling requirements.
   m. Unit shall be complete with self-contained low-voltage control circuit.
   n. Shall include low ambient head pressure control to allow cooling operation down to 0°F ambient.
2. Safeties
   a. Unit shall incorporate a solid-state compressor lockout that provides optional reset capability through CCN (Carrier Comfort Network), should any of the following safety devices trip and shut off compressor:
      (1.) Compressor lockout protection provided for either internal or external overload.
      (2.) Low-pressure protection.
      (3.) Freeze protection (evaporator coil).
      (4.) High-pressure protection (high pressure switch or internal).
      (5.) Compressor reverse rotation protection.
      (6.) Loss of charge protection.
   b. Supply-air sensor shall be located in the unit and detect cooling operation.
   c. Induced draft heating section shall be provided with the following minimum protections:
      (1.) High-temperature limit switch
      (2.) Induced-draft motor speed sensor
      (3.) Flame rollout switch
      (4.) Flame proving controls
      (5.) Redundant gas valve
3. Compressor Control
   Compressor shall be controlled by a Pulse width modulated control scheme that operates an unloading solenoid valve connected to the digital scroll compressor. The pressure differential across a pressure actuator inside the compressor lifts the upper scroll away from the lower scroll and provides the compressor unloading.

J. Operating Characteristics

1. Unit shall be capable of starting and running at 125°F ambient outdoor temperature per maximum load criteria of ARI Standard 210.
2. Unit shall be capable of operating in cooling mode down to an outdoor ambient temperature of 0°F.
3. Unit shall be provided with fan time delay to prevent cold air delivery in heating mode.

K. Electrical Requirements

All unit power wiring shall enter unit cabinet at a single location through the unit side or bottom.

L. Motors

1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
2. Evaporator fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection. Evaporator motors are designed specifically for Carrier and do not have conventional horsepower (hp) ratings listed on the motor nameplate. Motors are designed and qualified in the "air-over" location downstream of the cooling coil and carry a maximum continuous bhp rating that is the maximum application bhp rating for the motor; no "safety factors" above that rating may be applied. Evaporator fan motors shall be designed for use with variable speed AC drive controller.
3. Totally enclosed condenser-fan motor shall have permanently lubricated, sealed bearings, and inherent automatic-reset thermal overload protection.
4. Induced-draft motor shall have permanently lubricated sealed bearings and inherent automatic-reset thermal overload protection.

M. Special Features

Certain features are not applicable when the features designated * are specified. For assistance in amending the specifications, contact your local Carrier Sales Office.

1. * Full Perimeter Roof Curbs (Horizontal and Vertical Supply and/or Return Duct Applications):
   a. Formed of 16-gauge galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight. Roof curb corners shall be interlocking design.
   b. Permits installing and securing ductwork to curb prior to mounting unit on the curb. Field assembly required.
   c. Shall be available in both 14-in. and 24-in. height.
2. * Adapter Roof Curb:
   Shall be available for fit up to previously installed Carrier DJ, TJ, LJ, TF, HJ, TM roof curb (03-07 sizes).
3. * Integrated Economizer:
   a. Tilt-out economizer shall be furnished and installed complete with outside air dampers and controls.
   b. Low-leakage (less than 2%), opposing, gear-driven dampers with UL approved gears.
   c. Capable of introducing up to 100% outdoor air for minimum ventilation as well as free cooling.
   d. Damper actuator shall be fully modulating design with electronic control via 4-20 mA signal from ComfortLink controller.

e. Economizer outdoor hood shall be pre-painted and fully assembled.

f. Economizer shall be available for field or factory installation.

4. * Two-Position Motorized Outdoor Air Damper:
   a. The damper shall admit up to 50% outdoor air. Spring return damper closes when unit is off.
   b. The package shall include a multiple-blade damper and motors.
   c. Shall be available as factory-installed option and field-installed accessory.
5. * Manual Outdoor Air Damper:
   a. The damper shall admit up to 33% outdoor air.
   b. Shall include hood, damper plate, and screen.
   c. Shall be available as factory-installed option and field-installed accessory.
6. * Barometric Relief Damper Package:
   a. Package shall include damper, seals, hardware, and hoods to relieve excess internal pressure.
   b. Integrated barometric relief capabilities on economizer shall be available.
   c. Damper shall close due to gravity upon unit shutdown.
7. * Power Exhaust:
   a. Shall include two (2) propeller exhaust fans, 0.25 Hp 208/230 v, 460 v direct-drive motor on each, and damper for units with economizer to control over-pressurization of building. Single-stage control.
   b. Power exhaust shall fit on both vertical and horizontal configured unit.
   c. Shall be available as factory-installed option and field-installed accessory.
8. Single Enthalpy Sensor:
   The enthalpy sensor shall provide economizer control based on outdoor air enthalpy. The economizer control shall include logic to calculate the wet bulb and dry bulb temperatures of the outdoor air.
9. Differential Enthalpy Sensor:
   a. For use with economizer only.
   b. Capable of comparing heat content (temperature and humidity) of outdoor air and indoor air and controlling economizer cut-in point at the most economical level.
10. Convenience Outlet:
    a. Optional factory--installed powered convenience outlet shall be internally mounted with an externally accessible 115-v, 2-plug female receptacle with hinged cover. Shall include 15 amp GFI with independent fuse protection and service receptacle disconnect. The convenience outlet is powered from the unit main power wiring through a factory-installed step down transformer. The power wiring for the transformer needs to be field connected per local codes. This may mean wiring before the disconnect switch or after.
    b. Optional factory-installed non-powered convenience outlet shall be internally mounted with an externally accessible 115- v, 2-plug female receptacles with hinged cover. There is no step down transformer installed from the factory.
11. * Non-Fused Disconnect Switch:
    Shall be factory-installed, internally mounted, NEC and UL approved. Non-fused switch shall provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability.
12. * Unit Circuit Breaker:
    Shall be factory-installed, internally mounted, NEC and UL approved. Breaker shall provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability.
13. CO_2 Sensor:
    The duct-mounted or wall-mounted CO_2 sensor shall have the ability to monitor CO_2 levels and relay information to the controller. The controller will use CO_2 level information to modulate the economizer and provide demand control ventilation. The sensor shall be available as field or factory-installed.
14. Return Air/Supply Air Smoke Detector:
    The smoke detector shall send input to the controller to shut down the unit in case smoke is detected. The smoke detector shall be factory installed in the return air section or shall be available as a field-installed accessory.
15. Filter Status:
    The filter status switch shall be a pressure switch and will indicate a dirty filter. The switch shall be available as field or factory-installed.
16. Fan Status:
    The fan status switch shall be a pressure switch and will indicate indoor fan operation. The switch shall be available as field or factory installed.
17. * MERV-8 Pleated Return Air Filters:
    The filters shall be MERV-8 efficient. The filters shall be 2-in., pleated filters.
18. * Four-inch Return Air Filter Capability:
    The unit shall be capable of accepting field supplied 4-in. filters by removing a spacer rack.
19. * Low Range Fan Performance Motor/Drive:
    This motor/drive option shall provide low range motor and drive capability to enhance evaporator fan performance.
20. * High Fan Performance Motor/Drive:
    This motor/drive offering shall provide high range motor and drive capability to enhance evaporator fan performance.
21. Hail Guard, Condenser Coil Grille:
    Shall protect the condenser coil from hail, flying debris, and damage by large objects without increasing unit clearances.
22. Phase Loss Protection:
    Shall provide unit shutdown when an electrical phase loss is detected. Shall be automatic reset type.
23. Roof Curb Burglar Bar:
    Shall be 1/2-in diameter rod with 9-in. on center design grid pattern. Shall mount in roof curb openings.
24. * Space Temperature Sensor:
    Shall provide means to sense the space temperature from and adjust the evaporator fan airflow to satisfy the space temperature to set point.